LOKI

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THE LIFE OF CHARLES PROTEUS STEINMETZ

Courtesy of General Electric

"MY LIGHTNING DID THAT, MR. EDISON."

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the Life of Charles Proteus STEINMETZ

by Jonathan Norton Leonard

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DEDICATION

SOME centuries before Christianity the Norsemen invented a group of gods which stood, like all mythological characters, for types familiar to their inventors. Thor was the eternal strong man. Balder was the feebly gentle saint.

But one of these Norse gods was prophetic. Loki, the God of Fire, was a modern scientist, a person who, prophecy said, would destroy the gods and Asgard with them. He was master of all the undiscovered kinds of wisdom which the Norse dimly sensed and vaguely suspected. He understood Thor's thunderbolts better than Thor himself. When there was trouble in Asgard he gave the needed advice and laughed to see it accepted with such alacrity.

Loki was not a full-blooded god. He never quite belonged. He was half Frost Giant or Jötunn, the victim of a prehuman misalliance, the leader of a mythological demimonde.

And the prophecy that he would destroy Asgard —did that come true? Not at once. The robust old gods were replaced by feebler ones with haloes round their foreheads, and riotous Asgard changed into a spotless Heaven all white-tiled with mother-of-pearl.

But now in modern times all the Asgards are falling around the ears of their respective saints. And among the destroying modern Lokis is Steinmetz. He was also half Jötunn. He didn't quite belong. But his mind was one of the very best in the world.

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JONATHAN NORTON LEONARD

CONTENTS

	PAGE
PART ONE: SOME EARLY INFLUENCES	3
PART TWO: THE SOCIAL QUESTION	41
PART THREE: TURNING OVER A NEW CONTINENT	91
PART FOUR: THE ELECTRIC CITY	139
PART FIVE: THE HIGH PLATEAU	197
PART SIX: POLITICS	231
PART SEVEN: OBSERVING THE WAR	251
PART EIGHT: TOWARD THE END	269

LIST OF ILLUSTRATIONS

	FACING PAGE
"MY LIGHTNING DID THAT, MR. EDISON"	*FRONTISPIECE*
STEINMETZ'S FATHER WAS A LITHOGRAPHER IN BRESLAU	6
WITH HIS FIRST U. S. PAPERS AND TWELVE DOLLARS A WEEK	102
RUDOLF EICHEMEYER, REVOLUTIONIST AND PATRIARCH	118
A VOYAGE OF MATHEMATICAL DISCOVERY	178
PAPER, PEN, AND CIGAR	206
"LISTEN, MICROPHONE, I HAVE A GREAT DEAL TO SAY"	254
BACK-STAGE AMONG THE THUNDERBOLTS	278

PART ONE

SOME EARLY INFLUENCES

SOME EARLY INFLUENCES

Breslau, April 9, 1865

In a cheap flat on Tauenzienstrasse lay a woman about to give birth to a child. She was a strong, healthy German woman, and she'd had two children before by her first husband. There was really nothing to worry about. But the second husband, father of the unborn child, was nervous. He sat in the front room trying to suppress a constantly recurring thought and staring at a small mirror on the wall. He was almost afraid to look in this mirror. He knew what the glass would say. It would warn him not to have a child.

"Your father was deformed," it would cry out. "You are worse deformed than he was. Your child will be a poor little twisted thing, no use to the world and distressing to look at."

The father got up on his weak legs and paced crookedly up and down the room. He was not very much deformed, but small, with a head set down between his shoulders and a sad expression. He put

on a shabby hat and went out for a nervous stroll in the park. As he walked he hoped for the best.

When he returned the child was born, and the midwife had laid him in a basket all wrapped in flannel. It was a boy. Hesitatingly the father asked to see him. Like all newborn babies the child was bright red and lying in an awkward position. The father gave him a hasty glance and asked the midwife whether he was healthy.

"Oh, yes," she replied. "The left leg isn't just straight and there's a small hump in the back, but he'll live all right."

The father looked again and saw that the face was far from pretty. He felt that he ought to be remorseful but strangely enough he wasn't. He was considerably relieved and went out for another walk, feeling much more cheerful. The child was very like himself. He'd protect it in every way, for here was a real bit of his own flesh and blood.

The Benevolent Handicap

ABOUT Steinmetz's ancestors very little is known and that little isn't of much importance. They were plain people who lived here and there in Poland or eastern Germany and varied in nationality with the shifting frontiers. In race they were that confused

mixture of German and Slav which makes up the population of the region. By occupation they seem to have been townspeople not much above the peasants—innkeepers and the like. Not a spectacular lot, they gave no hint whatsoever that their entirely prosaic lines were converging toward a brilliant focus of genius.

But one trait passed down through the branches of this otherwise ordinary family tree had a tremendous effect on those individuals who suffered from it. Hereditary deformity was the curse of the Steinmetzes. They were not unhealthy or sluggish in mind or body but their limbs were apt to be twisted, their appearances strange, and their characters grotesquely individual.

A peculiarity like this does not always act as a handicap. Sometimes such a personal misfortune drives a lonely and desperate brain to superhuman efforts. The completely normal man has few compulsions to exertion. Easily and pleasantly he slips along the groove for which he was made. Like a good round penny he tinkles down the interior channels of the slot machine. There's a clink, a clatter, and out comes the stick of chewing gum, his contribution to progress. But the abnormal man finds no smooth groove waiting for him. He has to cut his own path and the process isn't pleasant. He works and sweats.

He tortures his brain into headaches and his eyes into burning balls of pain. Barriers of pleasure do not lie so thickly between him and his purpose. There's no enticing party to tempt him before every examination. No pretty girl to tap lightly on the close-locked doors of his mind, no frothy popularity beckoning to him over green athletic fields or polished dance floors. He has to *work*. And forcing him forward is the appalling realization that if he doesn't produce something rather important he'll be cast unjustly on the social dump heap. If he wants friends he must provide some financial or intellectual bait for them to swarm around. They won't come in the natural way, just because he's one of their set.

Of course this is too broad and uncertain a generalization to apply in all cases, but there's no doubt that it's sometimes true. A moderately intelligent man of pleasing physical appearance finds no difficulty in gaining the social recognition which he craves. But a little dwarf with a hump on his back—he has to work like the very devil, stick to his special job like a limpet, and maybe as a reward for heroic brilliance he'll gain a little of the easy pleasure which comes naturally to the normal man.

So it was with Steinmetz. What simple things he wanted and what mighty deeds he had to perform before he got them! No knight ever fought for a

STEINMETZ'S FATHER WAS A LITHOGRAPHER IN BRESLAU

plainer princess against more terrible odds. He wanted a home and friends, and he had to take an intellectual empire thrown in as largess. He wanted a rickety camp on the bank of a river and when he got it the whole world came silk-hatted to his door.

The White-headed Boy

STEINMETZ'S father was a railroad lithographer in Breslau. Although a rather intelligent man, his physical imperfection had weighed him down rather than forced him up. He married in 1864 the widow of his brother August, taking under his protection the two small daughters and gaining in this indirect way the home and family he passionately desired. Necessity is sometimes the best of matchmakers. At any rate the new relationship turned out happily. Perhaps the neighbours didn't expect any more children but one was born in 1865.

The child was named Karl August Rudolf, plenty of name in the German fashion. He was deformed and proved extremely difficult to manage. When his mother died of cholera a year after his birth the grandmother from Poland was called in to keep house for the family. On her fell the burden of training the unusual child.

As a young boy Steinmetz was fearfully spoiled.

Weakling children usually are. This undersized boy with the fragile legs and the big head led his grandmother a terrible life. His growing brain was too active for comfort. Stupid children are the easiest ones to get along with. They can be amused in simple ways. But young Karl was too bright to be satisfied with a few wooden blocks and spools. He wanted to make things that had never been made before; he did heroic deeds with candle grease and string. His grandmother would clean up the mess and gently beg him not to do it again. When the havoc was unusually serious she'd threaten to tell his father. The boy would fly into an uncontrollable rage and challenge them to do their worst. But the father couldn't bear to punish a child with a body so like his own.

Some families are like blockaded nations, united and wonderfully coherent. Their corporate souls are ingrowing and learn to find consolation within themselves. Human friendship and respect, if ardently desired, come in simple ways. So it was with the Steinmetzes.

One day the father brought back a magnificent kerosene lamp, a considerable novelty in those days. Glowing with pride, they placed it in the window where it gave light to all the street. Every evening the lonely little boy would wait for the moment for

the father to light the two great wicks with ceremonious care. In that dark age of candles and whale oil the lamp was almost a lighthouse in the neighbourhood. The boy would watch its steady flame for hours. In later years he still thought of it, and the mightiest arc lamp in his laboratory was dim beside its remembered brilliance.

The Child Is Father of the Invention

ALL intelligent children have in them something of the inventor. To be sure, they usually invent things already discovered several thousand years ago, but these are new to them and are therefore inventions in good faith. They retain this experimental state of mind as long as they remain children. It's only after they get old enough to have some knowledge of the established status quo that their minds become static.

The world to a child is very incomplete. It has to be explored and found out. The business of growing up is largely a matter of filling up the blanks in the structures of the world. As it happens, this is exactly the attitude of science. It is concerned with filling up larger blanks than those which worry the child but its ideals and methods are similar. Until the child gets old enough to worship "the best thought of the time," his attitude is that of the pure scientist. Find-

ing out about the world is the only mental activity which interests him.

Some children retain this experimental attitude throughout life. The best is never good enough for them. They never put a definite period at the end of their life experiences. These are the children who grow up into the leaders of modern science.

As an intelligent child and one cut off from many of the usual activities of childhood, Steinmetz did a tremendous amount of this youthful experimenting. The few toys and materials at his disposal were utilized to the full extent of their possibilities.

Among the things he had to play with were some wooden building blocks. He arranged these over and over again, copying as best he could some famous building he'd heard about. His grandmother, who was rather religious-minded, told him about King Solomon's temple. So one day he carefully gathered all the information he could about this structure and set about making one for himself. When it was done evening had come and the interior of the temple was quite dark. This didn't agree with little Karl's ideas of ancient magnificence so he ran into the kitchen and got a candle, which he lighted and placed in the temple's main hall. The light streamed out through the windows and he felt that at last he had made a satisfactory residence for the God of Israel. But the

candle flame was too near the roof. The blocks began to smoke, and grandmother hurried in, scattered the smouldering bits of wood, and put out the impending conflagration. Karl felt somewhat hurt—but then, all scientists have to get used to being misunderstood.

Another time he built a water wheel. It wasn't much to look at and was rather less in point of operation but it satisfied its designer. The wheel was made of two semicircular blocks and was set in a power house built of square ones. Of course there were numerous reasons why it didn't revolve. It had no axle, for instance. But young Steinmetz, following correctly the scientific method, decided to eliminate the defects one by one. He had no way of making an axle, but he could supply the wheel with water.

There was a pitcher standing on the sideboard and Karl managed to get it down. He poured the water over the wooden wheel and watched carefully to see if it would revolve. It didn't so much as quiver, and the water ran all over the sacred red carpet. But Karl wasn't worrying about where the water went. He was wondering why his wheel, which looked so perfect, didn't spin around when plenty of water was poured over it.

These are rather ordinary episodes. They could have happened in the lives of most children. But the point is that Steinmetz never outgrew this experi-

mental state of mind. He went on playing with things all his life, and as he became able to manage more complicated tools and methods his discoveries began to be of real importance.

Some men are born to conform to the existing state of things—to learn how things have always been done and keep the world running smoothly along its accustomed grooves. Some men are born to make new discoveries—to fashion new tools, to push out new salients into the blank spaces which surround us. Steinmetz was one of these.

Three Times Three "R's"

WHEN the boy was four years old the family made a half-hearted attempt to send him to kindergarten. This was a pleasant place intended to act as a buffer between the indulgence of home and the rigidity of the Prussian school system, but to the spoiled little cripple it was a fearful prison with no grandmother to yield to his whims. The teachers didn't seem to realize that he was somehow different from the other boys. He didn't like this first contact with the world. When he returned at noon he raised such a fearful and tearful row that his father didn't send him back for another year.

As soon as he did get used to the school he became

interested, for he saw that here was his chance to excel. At first he was rather unsuccessful. Bright children often are. They have too much intellectual self-respect to subordinate themselves completely to the rather mediocre minds of their teachers. They won't stick to the narrow cinder path which is the whole firmament of elementary knowledge. They wander independently and pick fascinating idea flowers. They become amazed and confused by the vast swarms of things to be learned. They see vague but alluring visions of wonders held just beyond their reach. Dull children attend more strictly to business, for they don't see these visions. The moderately dull are at first far in the lead.

As the school years pass the cinder path becomes wider and after the manner of wide cinder paths becomes less covered with cinders. Ideas actually grow within its limits. The bright child is more willing to keep within bounds, for the bounds are less sharply defined. When in three years young Karl was ready to enter the *Gymnasium,* his mind was awake, and the desire to learn filled his whole being.

The educational system of Prussia in the 1860's was very different from what it is now. There was no *Realschule,* no school where the technical student might be prepared for the semi-scientific positions so essential to modern industrial society. The schools

were still run on the old-fashioned conception that the only people who need education are gentlemen and that the only education a gentleman needs is a thorough knowledge of the classics. When five years old the pupil studied Latin and studied it desperately. At seven he studied Greek and sometimes Hebrew. Arithmetic, algebra, geometry, and French were taught, but not stressed. And if the teachers had heard of science in the abstract they never admitted it officially. There was as yet no sign of that vast system of scientific secondary schools which now launches the German youth so effectively into the confusion of modern technology.

Whatever defects this school system may have had, it was certainly thorough. The student learned his classics appallingly well. The humblest *gymnasium* graduate would recite long passages from Virgil or Homer if given the slightest hint that someone would listen.

Steinmetz throve under this hard régime. His mind was like a steel trap with a filing system attached. It caught everything and let go of nothing. Excluded by his deformity from the pleasant time-wasting occupations of childhood, he made learning his recreation. With breathless eagerness he hunted knowledge as other boys hunt sparrows. His mind grew. It looked out from behind his timid eyes. He was always

safely at the head of his class, and the teachers began to look with wonder on this poor cripple, who had such a mighty intelligence locked up inside his poor misshapen head.

One Dress Suit

AT THE age of seventeen Steinmetz finished his course at the *gymnasium*. He felt very full of wisdom. Although a *gymnasium* corresponded roughly to a high school it had at that time a great deal more prestige. Not very many boys progressed as far and the student actually ready to go on to the university was looked upon as unusually learned. Graduation exercises were as formal and solemn as one of our college commencements.

To receive his final degree the student had to appear publicly on a platform and submit to an oral examination. The only exception ever made to this rule was in the case of a student whose work had been so remarkable that it seemed absurd to examine him with the rest. Very few of these exceptions were made.

For this ceremony the candidates as well as the examiners were required to appear in formal dress. The richer boys already owned dress suits; the poorer ones could borrow or rent them. Some might go to the length of buying an outfit especially for the

occasion. Young Steinmetz did this. It was to be his great day of triumph and he must look his meticulous best.

The seventeen-year-old scholar had unbounded self-confidence. For a week before the event he pictured himself on the platform answering the most difficult questions without a shadow of hesitation, and for once the centre of all eyes.

On the next to the last day he went to the schoolhouse to collect his belongings. On the official bulletin board was a notice. It was the almost mythical honour list and on it was only one name. "Karl August Rudolf Steinmetz," it said sonorously, "by reason of his exceptional scholarship is not required to submit to the oral examination." Sadly the young scholar folded up his dress suit. He never wore it again. Of course the honour was very great, much greater than any he might win on the platform, but it didn't seem so at the time. It merely emphasized the difference between him and his fellows, a difference he hated to recognize.

The next day young Steinmetz sat in the audience and watched his schoolmates perform. His name was read off by the principal, but it meant nothing to the crowd. All the honours of the day went to the second-best student, a boy who answered all the questions successfully, shone brilliantly in his new dress suit,

but wasn't quite good enough to be set apart from the rest.

Young Steinmetz thought for a long time about this matter, and the dress suit became in his innermost mind a symbol of the chasm that separated him from ordinary mortals. He saw plainly that all his life he would have to live rather lonely and apart, well up with the best in intellect but sadly handicapped in all those little ways which go to make up a man's happiness. How readily he'd exchange a stupendous mind for a fair and shapely body.

He never bought another dress suit. His family couldn't stand the strain, and by the time he was able to pay for one himself he realized that his place in the world would have to depend solely on the power of brain, not on appearance however carefully cultivated. With his bare naked mind he would have to win painfully the little social considerations which come easily to others by merely being measured for evening clothes.

Gestation of a Scientific Mind

SCIENCE is fathered by doubt and mothered by curiosity. No true scientist ever believes without proof or accepts any opinion, however profound, as the last word on a subject. The Lord God of Science

is still busy with the first six days of creation. He will never look upon his work and see that it is good.

The Steinmetz household had a non-religious atmosphere most favourable to the growth of a scientific mind. Although the father was not actively hostile to religion he didn't let it bother him and he took care to shield his promising son from its influence. He realized that religious training is apt to form in the mind of a child the disastrous habit of believing without proof. Pale hands from the years of infancy throw large monkey wrenches into the fragile machinery of reason. Inbred superstition never plays fair. If it can't cause active trouble it makes itself felt through bad mental habits: a desire to believe because believing is comfortable; a tendency to be shocked by the strong naked truth. Before a man can become a real scientist and not a mere technician, he must sweep his mind clear of all such cobwebs. It takes a strong intelligence to carry out this mental housecleaning, and much valuable time is lost in the process. In Steinmetz's mind the cobwebs were never allowed to accumulate.

This invaluable advantage of a cobweb-free mind, like so many other things about Steinmetz's character, must be attributed to the family's feeling of lonely inferiority. Skepticism is not fashionable among the working people and if the elder Steinmetz had been

an ordinary lithographer, prosperous in his trade and satisfied with the established order of things, he would probably have allowed his son to absorb at least the usual amount of mystical misinformation. The state religion of Prussia was an efficient machine designed to keep the lower classes quiet and in this it was generally quite successful.

But Father Steinmetz was far from being satisfied with things as they were. He was more intelligent than most men of his class and he felt keenly that his deformity and appearance had unjustly kept him down. Accordingly he had no taste for the comfortable religious sedatives of the humbly contented. He resolved that his son, whose genius was early visible, should not be hampered by the dragging train of religious misconceptions.

Of education he himself had none, but brooding sadly over his disappointments, he determined on this one thing. His son was about to enter into this wonderful new world of science where intelligence alone counted—not social graces, not pleasing appearance, not willingness to trim one's sails to the prevailing winds of society. Religious training for a scientist is negative education which has to be cancelled like the red figures on the wrong side of the ledger. He resolved that his son, like himself so sadly twisted in body, should at least start with a clean sheet.

In spite of his father's attitude toward religion the boy in due time entered the Lutheran Church. This was to avoid annoyances and to placate the relatives. The father was no man to bother about such trifles. He reasoned correctly that active opposition to the Church is almost as foolish as active belief. At any rate the ceremony was performed painlessly and was forgotten at once. The pastor made some illuminating remarks which Steinmetz remembered in later years.

"You may find," he said to the row of young students kneeling before him, "that as you pursue your university studies you will have no use for religion in your own lives. Still, you should not forget that ignorant people need it; therefore everyone should respect and preserve religion, since it is necessary to a certain extent."

The Germans have a curious way of looking facts in the face without squirming. That minister had seen the glory of the New God shining in the eyes of the little cripple kneeling before him. He didn't try to strike him down.

A Brain Comes of Age

THE University of Breslau has no smooth-shaven green lawns or luxurious dormitories. Its buildings

are merely buildings like any others in the city. The students live at home or in lodgings. There is no dining hall, no chapel. Above all there is no "college spirit," that most perfect of intellectual alibis. The student comes to learn, stays to learn, and gets his degree when and if he has learned. Loafers abound as they do elsewhere, but they are given no medals for loafing with distinction.

To this paradise of the knowledge-thirsty came eager little Steinmetz, his mind bulging like a large moist sponge impatient to suck up a tremendous draught of wisdom. Men who have been lost on the desert say that on taking their first drink of water they become unconscious of any sensation except that of drinking. One desire is being satisfied with such intensity that all others are temporarily silent. Steinmetz felt the same way when he entered the university. Here was a bottomless supply of knowledge. Here was he. Why shouldn't the two come together? Steinmetz felt that they should. For a year he did nothing but study, grind, and dig his way into that mass of knowledge like a starving mouse gone mad at the sight of a universe of cheese.

How exciting the first formalities of entering a university! The student pretends to be annoyed but he's really delighted with the ritual-like trooping from office to office collecting important-looking

blanks and catalogues. There's a rarefied solemnity about it all. Lecture rooms are the shrines and temples of the New God and the serious student enters into them with all the palpitations of the awe-struck novice taking his first vows. He feels the weight of centuries of learning pressing down from the old rafters. And if he's an ambitious little man like Steinmetz, he smiles breathlessly to himself, for behind each book, underneath each sheet of notepaper is a promised land far brighter than that which Moses saw from Pisgah. The Promised Land of Science is a hard one to enter but fame and satisfaction await the explorer behind every burning bush.

Steinmetz plunged at once into the revelry of learning. For a year he thought of nothing else. Numbers, theorems, and beautiful burnished hypotheses spun in his brain like whirling dervishes. It was a kind of drug addiction. The more of the drug he incorporated into his brain the larger dose he required. His notebooks became bewildering mazes of small angular writing and spider-web formulæ. In the lecture room the professors were amazed and delighted when the little cripple rose painfully to his feet and picked holes in their arguments with all the smiling satisfaction of a dentist looking for cavities.

His studies were technical from the first for he intended to make himself into some sort of an engi-

neer. But this did not mean, as it would now, a strict devoted to minor divisions such as electricity, hydraulics, or gas engines. The profession was not sufficiently specialized. An engineer might branch out later into some specialty but during his university years he usually stuck to the fundamentals.

So young Steinmetz took gloriously theoretical courses in dynamics, chemistry, and mathematics. This is growing food for the mind. It's the first romantic adventure of the idealistic young scientist who loves to tilt at windmills and hates the thought of practical application. In Breslau there was no solemn standing by a transformer and noting that five volts come out where ten volts go in. There wasn't a single transformer in the city. Indeed Steinmetz, who was to make transformers into the most useful and uncomplaining servants of electricity, saw not a single one before he came to America.

My Lady Mathematics

THERE'S a certain almost mystical charm about pure mathematics, a charm which pervades and tinctures the whole soul of the student. It's so totally abstract. You begin with the numbers, 1, 2, 3, etc. You learn that they can be added together, multiplied, and manipulated in simple ways to serve the purpose of

tradesman and housekeeper. Then you begin to see their more hidden secret qualities. There are negative numbers, for instance. These are interesting things. You play with them for a while and presently you realize that if you multiply one negative number by another negative number you will get a positive number not only larger than either but of an entirely different order of largeness. It is mysterious. You want to know more.

Finally, when you've juggled with these simple quantities, turned them upside down, turned them inside out, you begin to see short visions of fascinating qualities hitherto undreamed of. Some numbers are imaginary; they don't exist and can't exist. But nevertheless they can be manipulated just like real ones. The answer to a problem done with these unreal ghosts of numbers is just as correct as one done with your own ten fingers. This thrilling revelation is only one of many. Innumerable rules and principles swarm at the gates of the mind and when one of these has become established and naturalized it breeds a host of new ones which in turn present themselves for naturalization. Soon there's a dense population all yelling for attention. Mathematical intoxication is a common disease among students.

Steinmetz fell a victim at once to this disease. It was almost inevitable for he had that aptitude of

abstract visualization which makes the great mathematician. As soon as he attained full university membership he bluffed his way into a number of courses more advanced than those usually open to the beginner. It wasn't all bluff, however, for during his *gymnasium* years he had progressed far beyond the subjects taught to the rest of the pupils. He didn't have to bother with the preliminaries. He could plunge at once into synthetic geometry, advanced calculus, and the other bewildering mazes of higher mathematics.

In a book intended for lay readers it would be impossible to describe or attempt to describe the prodigious steps a young mathematician must take before he is really a member of the guild. Other subjects can be popularized by the time-honoured methods of misplaced emphasis and meaningless repetition but not so with mathematics. The more you try to simplify it the more obscure it becomes. It is essentially abstract. Its long words are not mere frills, as with certain less fundamental sciences, but are actual aids without which clear comprehension is impossible. To use these words to a nontechnical reader is as silly as speaking Chinese to one who does not understand the language, while to describe the subject without using them is as hopeless as trans-

lating Kant's *Critique of Pure Reason* into the two-hundred-word vocabulary of an Esquimau.

Let it suffice that Steinmetz did wonders with mathematics and won the unreserved admiration of his professors. Often a lecture which he attended was hardly more than a personal discussion between him and a delighted professor who revelled in the rare luxury of being completely understood. Between them the two would pick a subject to its bare bones, while the rest of the class took frantic notes or sat back in annoyed wonder while the little cripple and the bearded professor haggled over some remote rarefication of the subject.

In addition to being brilliant, Steinmetz worked amazingly hard. His notebooks, kept in a small type-like hand, could be seen visibly to grow in thickness day by day, while his never resting brain sifted their contents over and over until each principle and method was indelibly printed on his memory. And what a memory it was! Soon his mind became so packed with all the possible combinations of numbers and quantities that to solve a simple problem required almost no conscious effort. The operations became entirely automatic.

Mathematics is largely a matter of visualizing abstractly the relations of numbers. It is different from ordinary visualization merely in that it uses

different and far more complicated conventions. When the eye "sees" something the impression transmitted to the brain is not the same as the picture which comes in through the pupil. This latter is made up of a certain amount of light of varying intensity, direction, and colour. The conventions of seeing bred into us from childhood enable us to translate this jumble of light into something with meaning. If we gave full value to each kind of light according to its intensity and amount, we would notice a pretty girl sitting under a tree perhaps only one tenth as readily as we notice the tree itself. We don't do this because the conventions of seeing tell us that the light reflected from that pretty girl means more to us than all the light reflected from the tree. To a frightened cat in urgent need of something to climb the picture would have different values. He'd see the tree first and probably not notice the girl at all.

In a similar way the mathematical mind learns to evaluate at once any symbolical expression. The trained mathematician looks over a complicated formula and subconsciously classifies its parts into the essential and the nonessential. Some numbers he ignores entirely; others he lumps together and scornfully calls them "K." They can be dealt with later. The remainder he manipulates without effort until they take a recognized form. Then he drops his pencil

and looks up the value of that form in a book. It's all very easy, but to the layman the original formula looks as hopeless and meaningless as the nursery looks to the newborn child. Neither has enough machinery of convention to deal with his problem.

Thus mathematics is learned. Steinmetz accumulated the indispensable machinery with amazing speed. His mind became as infallible as an adding machine. If you gave him a problem to solve, he'd close his eyes for a moment, smile mildly, and give you the answer at once in its most convenient form. No wonder the professors greeted him warmly when he hitched his way crablike into their classrooms.

The Metal of the Future

ONE of the chief joys of Steinmetz's early university career was taking his knowledge home bit by bit to his worshipping father. The two were bound together by stronger bonds than hold an ordinary father and son. Common affliction makes firm friends. The older man had always revered knowledge but to him it was an unattainable ideal—an ideal to be touched humbly as the peasant touches the robe of a passing cardinal. When his own son came home in the evenings clad, so it seemed to him, in the most gorgeous robes of scientific learning, his delight was beyond

belief. Reverently he'd ask a timid question about some subject, the name of which he could barely pronounce, and he'd almost burst with pride to hear his son, *his own son,* plunge into a discussion of all its most difficult phases.

The two were very happy. Young Steinmetz was earning admiration at the university. The older man was feeling the first thrills of paternal pride and these were doubly sweet because the son was twisted like himself.

"We'll show what we're good for," he'd say to himself in the long afternoons as he worked away with his delicate lithographer's tools. "We'll show them that fine bodies don't make the whole man."

The father's pleasure reached its height when the son announced that he'd like to have a laboratory in his room. An alcove was at once set aside for this sacred purpose and such apparatus collected as the father's small finances could afford. Whenever the young scientist could spare the time he worked in this messy corner, attempting usually some absurdly ambitious experiment utterly beyond the capacity of his few poor beakers, batteries, and test tubes.

One day his father came into the room while an experiment was going on. He picked his way carefully so as not to disturb any of the apparatus. His son was standing over a porcelain pot filled with a white paste

into which were stuck two copper wires. Nothing much was happening.

"So," said the older man, "you are making something?"

"I am reducing aluminum to the metallic state by action of the electric current."

"So-o," said the father. "And it will be a metal?"

"It will be aluminum, the metal of the future."

"It will be used in the future?"

"It will replace iron and copper for many purposes."

"So-o-o."

The father didn't think it best to say anything more. It might disturb the mysterious electric current. He watched the pot of white mixture with interest. Nothing happened. Nothing could have happened. But he imagined that among the crumbs of salty-looking paste he could see small bits of shining metallic aluminum, the metal of the future.

Mathematisch Verein

YOUNG STEINMETZ was a gregarious soul and soon, in spite of his mathematical preoccupation, he felt a crying need for more companionship than his busy father could provide. He looked about him with hopeful eyes. The university was full of student or-

ganizations of every conceivable sort. He felt sure that there must be at least one humble enough to take him into membership. Of course the aristocratic duelling *Corps,* with their coloured caps and insolent manners, were out of the question. They played their rigid game of insult and satisfaction far above the heads of poor workingmen's sons. And even the *Burschenschafts,* although they had been born of the revolutionary movement of thirty years back, were too expensive for his slender means. Besides, no group of students held together solely by congeniality was apt to welcome this ugly duckling. What did they care if his mind was better than any of theirs and his warm young heart was bursting with friendliness?

But at Breslau as elsewhere were small societies whose members felt something in common besides congeniality. These usually centred about a science in which the members were interested. If a student found himself unable to meet the social requirement of the more frivolous societies he could always fall back on the humbler groups and often find in them as much pleasure as in a *Corps* or a *Burschenschaft.* Steinmetz's interests drew him into the mathematical society and here he found the companionship which he desired so ardently.

In spite of their meagre resources, German students manage to have a very good time. Unlike

American and English students, they are not surrounded by the accumulated luxury of generations. No opulent endowments care for their bodily wants while attempting to overcome their indignant inertia. They must make the most of very little for many of them are poor and the tuition charges, since the university depends largely upon them, are comparatively high. The small change left over for riotous living is very small indeed.

Luckily for the poor student there exists a wonderful ritual feeling toward beer and a traditional way of drinking it which yields a maximum of enjoyment at a minimum of expense. Beer is cheap and not strong, student songs are easy to sing and cover every imaginable subject; the will to enjoy is there in abundance. A gathering of German students in a dark little restaurant is a lesson to Americans, who are only too apt to measure the pleasure of an evening by its cost.

In his small room on Tauenzienstrasse young Steinmetz would look forward eagerly to the meeting of the mathematical society. Perhaps he'd divert the course of his thoughts long enough to prepare a paper to be read at the opening of the meeting. This was no trouble but rather a rest for his mind. He had left his friends so far behind that preparing a

paper for them was like patting a small boy on the head—pleasant and not at all fatiguing.

When the day came Steinmetz would be there as early as anyone, sitting in a corner with his paper before him and excited anticipation in his eyes. This was his greatest pleasure. These were the men who liked and appreciated him. Here was the one place where he could forget that he hadn't a fine figure and a handsome face to break hearts and win smiles on the streets of Breslau.

Presently the other members would arrive. They were a strange-looking lot. Most of them could be called grinds, that word which in its five letters expresses the highest admiration and the loftiest contempt. They were not among the élite of Breslau but they were friendly like all students before a beer-party, and their common interest in mathematics gave them a feeling of unity which otherwise would have been hard to attain. Some were serious; but none more serious than Steinmetz when he thought of the excellent paper he was going to read. Some were gay; but none more gay than Steinmetz when he thought of the songs and laughter to follow. He hugged himself with delight when his friends came one by one into the stuffy little room.

When all were comfortably seated, and each had a mug of beer before him, the papers would be read

and discussed. Sometimes an especially good one would be honoured by a vote of approval. Steinmetz would always vote in favour of such a motion. He was feeling so friendly and at peace with the world that no paper however bad seemed unworthy of praise.

After the last serious business had been concluded a fresh supply of beer would be ordered and the meeting would settle down to the *gemütlich* part of the evening. There was infinite formality about beer-drinking. Sometimes a beer master would preside and see that each toast was duly drunk and that new toasts were constantly being proposed. Some student with a good voice would lead a swinging mediæval song while those whose voices were considered a liability would join in the spirit of the song by emptying their glasses at the end of each chorus. As the evening wore on the humour became broader and the songs became more of one kind. The final period was called the *Suitas*. All restrictions were removed and each man was at liberty to drink as much as he liked and sing whatever song came into his head.

These parties would often last until very late, the more enthusiastic members keeping on until morning, when they would have breakfast and go to their eight-o'clock lectures. Steinmetz rarely went home until the meeting broke up. He wished to prolong

this day as much as possible. When he finally returned to his studies, he felt renewed in spirit. He resolved to work even harder, so that there would be more pleasant evenings, more comrades and genial songs in the future than he could hope for now at Breslau.

Proteus

EVERY German student has a nickname even if he has only one friend to call him by it. These nicknames may be mere contractions of the regular first name or may grow out of some personal peculiarity. But often they are bestowed formally at a special club meeting called for the purpose.

Steinmetz came to such a meeting with some misgivings. The traditional nicknames were not apt to be tender ones. He might come out with a name which would stick to him like a curse for the rest of his life. Many had done so before him and his appearance certainly offered plenty of opportunities for practical jokers.

The "foxes," or first semester men, were lined up before the committee and as each man was called he would step forward to receive the name which was to be used in all future meetings. Steinmetz was the third in the line. The first man was called. He stepped up and with a pleased smile received the name of

"Archimedes." He never learned the reason for this, but "Archimedes" he remained to the end of his university career. The second didn't fare as well. He was given the name of "Agag," the unfortunate king of the Amalekites who was "hewn to pieces before the Lord." This was because of a calling down he'd suffered from a short-tempered professor. Then it was Steinmetz's turn.

Painfully on his thin legs the young mathematician hitched forward. The chairman of the committee looked up with a smile. He raised his beer mug.

"Half a glass to Proteus," he said. "Proteus the versatile, the ever changing, who knows economics, classics, and mathematics, who can answer questions on every subject."

The members drank duly their half glasses and Steinmetz sat down. He was Proteus now. It might be worse. He thought it over. There were worse names. But he knew his classics too well to be completely delighted.

When the meeting broke up Steinmetz walked home slowly and alone. He was turning the new name over in his mind.

"So," he thought, "they call me Proteus because I'm versatile and quick-changing. Perhaps they think I don't know more about Proteus than that. But I know the Odyssey from beginning to end. Proteus

was the old man of the sea. That's what he was. If you caught him he'd change in your hands to a hurricane, to a fire, to a sea serpent. But if you kept firm hold he'd finally change back to his real shape, a wrinkled old hunchback, and tell you all the secrets of the world."

He hitched along crabwise for a few blocks. It was late and the widely spaced street lights made his shadow even more grotesque as it writhed on the pavement.

"Yes, I'm the old man of the sea. I'm Proteus. I shall keep that name and post it up where all the world can see it. And if anyone sticks to me through thick and thin I'll tell him secrets the world has never known before."

He hitched on again in the darkness toward his bleak little room on Tauenzienstrasse. Those same street lamps are brighter now and Steinmetz had a lot to do with it.

PART TWO

THE SOCIAL QUESTION

THE SOCIAL QUESTION

Raw Materials of Revolution

A MAN could no more live in the Germany of the 'eighties and be unaware of the Socialist agitation than he could live in modern America and be unaware of Prohibition. It was talked in classroom and beer garden, in opera house and salon. Large workingmen with arms like tree trunks would confound elegant officers by throwing beer in their faces and laughing at their baffled inability to deal with a non-gentleman by the traditional formula of the duel. Small illegal newspapers would flutter from hand to hand in the poorer quarters. Some would flutter into university classrooms to be embroidered with lofty philosophical sentiments; others would flutter up into high places to be greeted with Bismarckian wrath and replied to with platoons of police, columns of goose-stepping soldiers, and prison sentences.

Germany was just then making a rapid change from a feudally organized agricultural country to a modern industrial state, and like all countries in such a condition it seethed with unrest. There was trouble

all over the place. The new manufacturing centres attracted millions of workmen who counted their millions and for the first time realized their strength. They felt the confidence bred of overwhelming numbers. But when they tried to take part in the government they found that by official chicanery their influence had been reduced to almost nothing. A handful of magnates might put one of their own number into the Reichstag while it took a million votes or more to elect a Socialist.

Perhaps the most significant thing about this movement was that its leaders were to a great extent members of the intellectual class. The universities were full of agitators. The school teachers were in it too. The funds for organization and propaganda came largely from non-proletarian sources. The agitation was not a mere blind grabbing for higher wages and shorter hours. There were powerful intellectual forces behind it. The German government was determined to extend the mediæval system over the new territory of modern industry, and the liberal forces of the country were determined to have a complete new deal.

Most governments now recognize that the interest of the university students in a political movement is a measure of the depth of that movement. When agitation is motivated simply by class selfishness or simple

prejudice, the students stick to their books and have nothing to do with it, but when larger questions of right and wrong, progress and reaction are involved, the students take an active and leading part.

Such a movement is very hard to suppress for the students are the future leaders of the country's thought. In a few years they will control the press, the professions, and the more intellectual phases of business. A wise government watches the students very carefully for in the youthful rantings of a student orator it can perhaps see the first flickers of inevitable change.

But Bismarck for all his astuteness saw nothing of this. He had a policy which, he stated, if rightly carried out would make Germany the most powerful country in the world. The new industrial empire was to be organized like the smaller Prussia of Frederick the Great. Intelligent autocracy was to lead. Well-trained science was to follow. And the people, obeying like superior sheep, were eventually to reap the benefits of efficiency and enlightened leadership. Benevolent autocracy was to be applied entire to modern industrial Germany.

This policy has the advantage of logic and simplicity. It would be the first for an averagely intelligent person to think out. But it is too simple. Bismark expected opposition; he was used to it, and

had overcome it many times. But this time he didn't heed the still, small voice crying in the classroom.

In a properly organized state the proletariat is a headless creature, for as soon as new leaders develop in the ranks they at once rise above their environment and enter another class. This leaves labour with no better leaders than workmen with louder voices and stronger muscles than their fellows. They can not make themselves heard by the general public. They can cause no more serious disorders than futile squabbles about wages and easily suppressed riots outside the factory gates.

But in the Germany of Bismarck no such easy path lay open to the ambitious sons of workingmen. They could enter the university and learn as much as a young bourgeois but when they got out into the world they found that the cards were stacked against them. Bitterness developed and the Socialist agitators found sympathetic audiences among the poorer students. As for little, homely, hunchback students with topheavy brains, they became Socialists almost as soon as they learned what the word meant.

Meet Idealism

One evening Steinmetz was sitting in the corner of the restaurant which served as clubroom for the

mathematical society. He had a small audience and was expounding some abstract technical point so far away and highly rarefied that the faces of his listeners had already become hypocritical masks covering shamefaced mystification. He never noticed this expression when it appeared so he went on talking, getting more and more excited and more enthusiastic. His brain was wound up like a clock spring. It had to whirr on till it stopped.

One by one his listeners drifted away. They weren't bored. Steinmetz's conversation never bored anyone. He was so enthusiastic himself that boredom was out of the question. But it dents the ego to have a man of your own age talk so far above your head.

One listener remained. This was Heinrich Lux, a student from Upper Silesia whom Steinmetz knew rather better than he did anyone else. He wasn't listening to the lecture; he was only pretending to listen while he waited for a chance to get a word of his own in edgewise. He was nervous, with somewhat the nervousness of a young man making his first improper proposal—rather afraid of being overheard and very much afraid of the consequences if his offer were rejected. He let several good opportunities go by.

Finally Steinmetz paused to draw breath. Lux leaped into the unusual gap of silence.

"Proteus," he said, "I know you are a serious-minded person."

"So," said Proteus, his mind not at all disconnected from the train of mathematical reasoning.

"Yes, and I think you would enjoy meeting our little group of serious thinkers."

"And then," said Proteus, beginning to take notice. He loved to meet people. He met so very few.

Lux took courage. Here at any rate was no active opposition. In Breslau at that period any veiled references to "thought" or "thinkers" meant just one thing—Socialism! Proteus must have seen the trend of the conversation. He wasn't so dumb outside his specialty as some non-mathematicians maintained.

"To-morrow night at seven o'clock," Lux whispered hoarsely, "we are having at my house a little meeting of the Breslau Student Socialist Society. If you are interested in the Social Question be there a little after the hour and give the password *'sigma'* to the girl who opens the door. Remember—to-morrow at seven o'clock, and *'sigma.'* "

Lux turned hastily and went out the door. The restaurant was beginning to fill up and he saw on the lips of Proteus a multitude of indiscreet questions.

Proteus considered the matter excitedly. He

vished Lux hadn't left so soon. He'd never thought of himself as a Socialist before but perhaps he was one. Yes, he saw plainly now that he actually was one. The injustice of society surged up before his eyes in a way it never had before. The working classes were oppressed. Thought was proscribed. Progress was at a standstill. In fact things were in a bad way. But he'd never thought much about it before.

"Sigma"

THE next evening he appeared at Lux's house at exactly a quarter-past seven. He was palpitating with excitement. Delicious thrills ran up and down his crooked spine. His hand trembled when he reached out to pull the bell and his brain was filled with a lofty stentorian idealism.

Resolutely he gave the bell handle a hard pull and shuddered with delight when he heard a faint tinkle deep within the house. After some delay the door opened and a young girl looked suspiciously out through the crack. Proteus pronounced the magic word *"sigma"* and she smilingly opened the door wider. He passed inside and entered a new period of his life.

All this business of passwords and secrecy was a delightful game to lonely Proteus. It was like play-

ing pirates or Indians. Only he couldn't play pirates when he was a boy. It was a game of much scouting and skirmishing, many bold advances and hasty retreats; a game of muscle and agility, and he was forever barred from such. But here was a game played with wits by grown-up men, and a game with a lofty cause at stake. Proteus was bursting with importance and idealism when he entered the small back room which had a curtain hung over the door.

Within were half a dozen or more students smoking pipes and drinking tea around a small table covered with a red cloth. They rose to greet the newcomer and Proteus was presented to each in turn. Some were strange-looking, all were quite evidently poor, but all had the blessed light of intelligence shining in their eyes. Shining it is true with a slight tint of fanaticism, but shining nevertheless.

The meeting was called to order and the business of the day was taken up with true German methodicalness. There was actually very little business except the discussion of principles and the passing of broad resolutions. The students had money for little besides talk and tea, both of which are cheap.

But in each member was a high idealism and a passionate devotion to the Cause which made Proteus feel that he had grown at least a foot in stature. He said very little at this first meeting, keeping his

thoughts to himself. There were enough thoughts flying around loose to make further addition superfluous. A little government persecution can produce in students a mental activity quite unheard of in stable countries.

Proteus walked home that night feeling very uplifted. Mathematics at best is an unemotional business. Steinmetz probably put more emotion into it than anyone before or since but it didn't satisfy his excitable nature. Now he had an interest more packed with thrills than any in his experience. Socialism ranks with love and war in its ability to call up enthusiasm and devotion.

The Joys of Minority

FROM then on Steinmetz regularly attended the meetings of the Socialist Society. He took the same delight in it as he did in the mathematical club. There he'd meet men who'd appreciate him for his intelligence and not look with too much interest at his crooked back. Socialists are tolerant folk toward those who agree with them. That's why so many peculiar people are Socialists.

The meetings were conducted with great secrecy. Steinmetz and the others probably overestimated the danger of police interference but nevertheless it was

a real one and ever present. The government was trying in every way to dry up the springs which fed the Socialist Party in the Reichstag. Once a member was elected, he was immune from arrest or suppression, but the individual voters who elected him were not safe from the crudest kind of persecution. The government was in a great state of nervousness about the Nihilist movement in Russia. Propaganda kept seeping over the border from Poland and the authorities were afraid that if too many Socialist members were elected to the Reichstag the party might stop talking and do something.

This was just what the party was preparing to do. Its two wings were getting together. The dissatisfied workmen were finding effective leaders among the uneasy idealists of the universities. The Socialist vote grew at every election, and old Bismarck stamped his foot and tore his hair when he found himself openly defied in the Reichstag and surreptitiously hampered elsewhere.

He had numerous weapons against this sort of agitation and he didn't hesitate to use them. Freedom of speech and press had never been firmly established in Prussia. The Reichstag members could not be arrested for anything they said but they were allowed to do their hell-raising only in the chamber itself. It was a crime to attend a Socialist meeting and a crime

to print or even possess a single copy of a Socialist periodical.

No wonder the students attached themselves to the movement out of pure love of trouble.

Defiance

INTO this maze of fascinating intrigue Steinmetz projected himself with his usual enthusiasm, and also with the courage born of slight experience and little knowledge of the situation. It was all a game to him, albeit a game played with real weapons and a desperately real cause at stake. Nowhere did he feel as important as at a Socialist meeting and never did he feel as noble as when he voted a loud "yes" on some resolution favouring action immediate and direct. This action was never taken. The German Socialist Party, like everything German, was peaceful and orderly. It worked in quiet rational ways and eventually got what it wanted. But Steinmetz's mild eyes would gleam with boyish delight when some hothead pounded on the table and breathed death and destruction.

About the time Steinmetz became interested in the movement the government began to take determined steps to destroy it. Bismarck was getting worried. His policy so far had been to build a strong Germany

on the foundation of strict discipline and enlightened autocracy. The Socialists were undermining this foundation and the great chancellor was afraid that the whole structure would fall. His police began snooping about with methodical diligence, and what the Socialists called the Reign of Terror started.

This Reign of Terror was an orderly German one and not very terrible. Plenty of arrests were made but the maximum penalty was a short term in prison. There was no such thing as political execution or exile to Siberia. And prison to a university student was not at all an unpleasant experience. He could have as many books as he wanted from the university library and confinement gave him a wonderful chance to get a lot of work done. Imprisonment carried with it not a bit of disgrace; it was even fashionable. The university itself had a prison where minor offenders were punished. One could be locked up for getting drunk, singing too loudly under the windows of the rector, or for kissing the wrong waitress in a beer garden. No student could feel very much disgraced if in the next cell was a gay young blade locked up for an excess of gallantry or an overdose of *Bock*.

Nevertheless the Socialists were soon made to realize that a determined authority was taking steps against them. Meetings had to be held with even greater secrecy, and when a Socialist member of the

Reichstag came to town to speak, the most elaborate precautions had to be taken to free the gathering from police interference. Certain suspected comrades would be sent out to act as decoys. They would gather at some restaurant and with much loud talk would act expectant, as if about to welcome a celebrity. When the meeting was well under way in another part of the city they would scatter suddenly and go home, leaving the baffled police to finish their beer and wonder where the enemies of law and order had really intended to meet.

About this time the Student Socialist Society of Breslau made a serious misstep. The members had their pictures taken grouped in attitudes of stiff-necked idealism about the bust of Lassalle, who was then the most conspicuous leader German Socialism had produced. This would not have been fatal in itself but the photographer foolishly exhibited it in his window alongside of the usual assortment of blushing brides and annoyed babies. It was at once pounced upon by the first cop with wit enough to recognize the bust and from then on it was used by the police as a rogues' gallery and a guide to Breslau Socialism.

Steinmetz was in this group, standing in the back row with his long arm on the chair of an innocent-looking Jewish youth, eyes half closed and seemingly

very pleased with the proceedings. Having one's picture taken in a compromising situation is powerful balm to the ego.

The Tyrant Strikes

One evening Steinmetz was calling at the house of Heintz Lux, the man who had first introduced him to Idealism. They were discussing Icaria, an embryonic Socialist colony in California, from an investigation of which a comrade had just returned. Icaria was not developing as it should. It was prosperous enough but not as socialistic as it should be. The colonists found it too easy to skim an opulent living off the fertile soil. They had a deplorable tendency toward a change of heart. The organization of the world wasn't as completely wrong as they'd thought while in Germany.

Lux was inclined to denounce them as traitors to the Cause. The colonists had been sent out there for a purpose, he argued, not for their individual gain. They were to prove that a Socialist community, if favoured by Nature and inspired with sufficient fervour, would develop into an earthly paradise so much more pleasant to live in than the surrounding capitalistic society that the skepticism of the world would be overcome. They had succumbed to the blandishments

of bourgeois prosperity. They deserved excommunication, no less, and if possible more material chastisement.

Steinmetz was not as drastic. His kindly nature made it impossible for him to feel active resentment against anyone. The Icarians were, no doubt, strongly tempted. His own mouth watered at the thought of California fruit and the famous California weather which did just what you wanted it to all the time. He had an heretical idea that Socialist colonies should be sent to Scotland or Newfoundland, somewhere where getting a living wasn't as easy as in golden California. Perhaps Socialism wasn't the natural political philosophy of prosperous communities.

Lux looked at him with horror. Here was treason in the very inner circle. He quoted from the numerous sacred books of Socialism; he invoked all the great names of the saints; and he would undoubtedly have proved beyond all shadow of a doubt that Socialism was the natural state of society and capitalism a noxious growth—if the door hadn't suddenly opened before two burly policemen, who marched up to Lux, arrested him in the name of the law, and bore him off protesting.

Excitable little Steinmetz completely lost his head. He ran around in circles, babbling incoherently about justice and outrage, trying vainly to reassure

Lux's terrified mother, and accomplishing very little but making a considerable addition to the general uproar. When captive and captors had finally gone he sallied forth to spread the alarming news to the rest of the comrades, who gathered panic-stricken in the favourite café to discuss the situation and see if anything could be done about it.

Very little could be done. Lux was held *incommunicado* until the public prosecutor should gather sufficient evidence for conviction. He was allowed to see no one. His cell was said to be comfortable and apparently there was no danger of immediate proceedings. His friends would have time to prepare a careful defense.

Steinmetz went to bed that night with his heresy completely jolted out of him. Where before he'd been a mild theorist just on the verge of returning to conservatism, he was now a wild radical in favour of action as direct and immediate as possible. His best friend had been borne off by the tyrant. Society was in a pretty bad way after all.

The Pen Is Mightier Than the Handcuff

For the next ten months Steinmetz's mathematical meditations were constantly disturbed by a disconcerting thought. Lux was in prison. He would presently

be tried and if all went well with the plans of the public prosecutor he would be sentenced for a considerable term. And what would happen to the rest if their leader was taken? He was no more guilty than they. His conviction might be followed by a sweeping clean-up of all the student Socialists.

The thought of physical force directed against his weak body had always been a terrifying one to Steinmetz. He was not brave in body. Weak creatures cannot afford to be. His infirmity had always saved him from the necessity of facing any physical issue. Even the stern German schoolmasters had spared the avid rod. So the picture of his friend Lux shut up in a harsh prison surrounded by burly keepers was always rising vividly before his mind. He shuddered when he imagined his own frail body carried off between the shoulders of two large policemen, the legs dangling like pieces of limp string or dragging vainly on the pavement.

Nevertheless, in spite of these forebodings and moments of pure funk, he set about loyally to free his friend from prison—or at least to make his final conviction difficult. As it happened this was not very hard, for the government had arrested Lux purely on suspicion and without any definite charges against him. It was a hopeful step in the dark and like many steps in the dark this one found very insecure ground

underfoot. Since the evidence at hand was scant and there was little prospect of gathering any more the government undertook to fill out the scattered clues by keeping Lux out of communication with his friends and comparing his statements with theirs. If they checked up the prosecutor could be fairly sure that both sides were telling the truth, while if they didn't he would be safe in sending the police out to do a little research.

The problem for Steinmetz and his friends, if they wished to save Lux and incidentally themselves, was to establish communications so that they would know how the prisoner had answered the prosecutor's questions. Then they could give the same answers.

It was lucky that a little before Lux's arrest he and Steinmetz had discussed this matter of communication and decided to use invisible ink. There are plenty of common chemicals which can be used for this purpose. Lemon juice will do very well, and permanganate of potash, used in Germany as a mouth wash, can be combined with certain ingredients contained in other toilet preparations to form a colourless liquid which turns brown on slight exposure to heat. Lux was allowed to have all the toilet articles he wanted. He naturally wasn't allowed to write or receive letters but Steinmetz reasoned that if he provided him with the permanganate, Lux's ac-

tive mind would at once recall their conversation about invisible inks.

So with the next lot of books from the library Steinmetz included a bottle of permanganate, the proper toilet waters, a toothbrush, and two steel pens. Lux was allowed to have pens for his work and he already had several, but Steinmetz wanted to make the suggestion as strong as possible. He stuck the pens in the cork of the permanganate bottle.

Every morning Steinmetz went to the prison gate and asked the warden whether he could do any errands for Lux. The first morning there was no errand, but on the second, Lux returned one book and asked for two more, the names of which were on a slip of paper in the keeper's handwriting. Steinmetz tucked the book under his arm and hurried home so eagerly that he almost trotted.

He looked hastily on the fly-leaves, and there sure enough on the first one was a small cross in pencil. He tore it out and held it over the kerosene lamp. Nothing happened for a moment but as the paper got thoroughly heated small pale brown letters appeared as by magic on the white surface. It was Lux's handwriting. Steinmetz carefully heated the whole surface until the complete message was legible. Then with excited thumpings of his heart he sat down to read.

Lux told all about his cell, which was comfortable, and about the questions of the public prosecutor, which were rather disconcerting. It was the prosecutor's policy to tell his prisoners that their fellow conspirators had confessed and that if they wished to save their skins they had better make a clean breast of their own participation. Lux didn't believe this to be true and so hadn't committed himself, but he wanted to know just what had happened and said that he would watch for the return message with eagerness.

There was also an affair of the heart which Lux was afraid might lapse if a few gentle words didn't come from time to time from behind the cold prison walls. He was afraid that absence might make the lady's heart grow warmer toward those luckier suitors who were not absent. Would Steinmetz please develop his letters and deliver them to the girl, taking particular care to make the circumstances as romantic as was consistent with discretion?

Steinmetz was of course terribly wrought up by all this business but on the whole he enjoyed it hugely. In later years he used to refer to this period with relish as the most exciting part of his life. Particularly he enjoyed the rôle of messenger between Lux and his girl. It was the first contact he'd had with matters of the sort and he got intense pleasure out of

transcribing the young lady's letters with invisible ink in the fly-leaves of library books. Nature sometimes forgets herself and is kind. She was kind when she made it possible for the unfavoured to enjoy a vicarious love affair.

Mr. Chairman

BETWEEN his mathematics, which was now beginning to merge into the still mysterious subject of electricity, and the constant excitement of the Socialist intrigue Steinmetz led a hectic life. He was either working frantically with his pencil or attending a Socialist meeting and eagerly listening to the sulphurous indignation of the comrades. He liked these defiant speeches. They showed a certain recklessness and courage which he didn't himself possess and which he consequently admired in others. He left such a meeting much fortified within. If there were such fine fellows fighting for it the Cause was bound to win. He hadn't met any of the other side except the shock troops—policemen and the like—but he was sure that they couldn't be nearly so wonderful.

His political interests didn't keep him from his work. Nothing could do that; scientific reasoning had become so necessary a part of his daily routine that he couldn't be comfortable without doing a generous

amount every day. His worries about Lux were never able to impair his complete concentration on the particular problem then being operated upon by his pencil. Socialism throughout his life never amounted to more than an exciting avocation for his almost monorail mind.

After the first two years his studies led him gradually into the little-understood field of electricity. It was not a popular subject or one considered of much ultimate importance. The day of electricity had not shown any signs of dawning. When Steinmetz first devoted himself to its study there was practically no apparatus in common use. There was very little literature devoted to it and there was none of the intense popular interest which was presently to set every enterprising boy to learning the telegraphic code and messing around with batteries. At Breslau the whole subject was covered in a few hazy courses. In most universities it was not covered at all.

One evening Steinmetz attended a meeting of the Socialist Society with one of his electrical books under his arm. He had just made the acquaintance of a truth so comely and so fascinating that he couldn't bear to part from it even for the period of the meeting. He opened the book surreptitiously in the dull wait before the chairman called the members to order.

The meeting was considered an important one.

There were officers to elect and resolutions to pass. There was the matter of Lux, who still languished in prison, studying faithfully and sending out impassioned appeals in eloquent invisible ink.

The discussion went fast and furiously. As usual everyone talked at once. The resolutions were passed with much applause. Officers were elected, and a reassuring letter was sent to Lux. When it was all over, the chairman touched Steinmetz on the shoulder.

"Congratulations," he said. "I hope you'll do better than I did."

"What?" said Steinmetz, looking baffled.

"Yes, you will. You'll be a much better chairman."

"Chairman?" said Steinmetz, his mind not yet back on earth.

"Yes, chairman," said the other. "Much better." Then a great light broke upon him. He laughed rather forcedly.

"Comrades," he said, "the new chairman doesn't know he was elected. He wasn't listening."

The comrades all laughed. Some laughed genuinely, some were annoyed, while some were resentful. But they all laughed from the heart when they saw the flustered confusion of Steinmetz, who shut his electrical book with a snap and was desperately trying to look official.

When the meeting disbanded that night quite a

good many carried away some doubts about their talented comrade. He was bound to amount to something important. They knew that. But although he might never have trouble with the needle's eye, they were sure that he'd never remake the word in half an hour.

From One Scholar to Another

EVENTUALLY Lux was freed from prison and the Breslau Socialists had an interval of peace. His release was largely due to Steinmetz with his invisible-ink postal system. The prisoner couldn't be convicted when all his comrades outside the bars knew just what he'd answered to the prosecutor's questions. The whole gang were able to maintain such an attitude of truthful and outraged innocence that it was very difficult to extract any proof of their conspiracy.

There was nothing for the authorities to do but free Lux. So freed he was. The prosecutor watched him go without enthusiasm. He was plainly guilty. His very manner showed that. But it was impossible to prove. The clumsy minds of the police were helpless before the ingenuity of the little electrical student. It's an unlucky police force which has to deal with students. The police official's mind soon becomes like that of his constant associate, the low-grade

crook. It loses the flexibility necessary for dealing with the resourceful and intelligent student.

Now that their first bird was again in the bush the police turned their attention to Steinmetz, whose activity in the defense had brought him under suspicion. Unable to collect any definite evidence about him they decided to resort to other means to stop his activities.

One morning Steinmetz got a note asking him to come to the office of the rector. This august person was head of the university and was also a professor renowned for his learning and dignity. Steinmetz when he entered the book-lined study was afflicted with a bad case of awe. He stood abashed before the pomp and circumstance of academic majesty. The books were all leather-bound. The desk was old and highly polished. The rector had a biblical white beard. So the little student of electricity felt that he must be guilty of innumerable crimes to be brought before so worshipful a judge.

The rector spoke in a pleasant but somewhat too impressive voice. He said that Steinmetz had been complained of by the police, who said that he was plotting against the government, was aiding certain criminal agitators, and generally was behaving as no university student should. "Is this so?" asked the rector.

"I think," replied Steinmetz, "that I have done nothing particularly reprehensible. And you will find, honoured sir, that I have kept up my work in a very complete fashion."

"I have already discovered that," said the rector, smiling, "and——" He beckoned to Steinmetz. "Come nearer," he said in a lowered tone. "And I should be very sorry if the police should interfere with one of the most talented students we have ever had in the university. Your record, sir, is excellent. Try to keep out of trouble with those silly police. Remember that science is more important than all the Socialism in the world. The scientist is the future ruler of the universe, not the bawler outside the factory gates."

Steinmetz didn't take this lesson much to heart, at least not at once. But he thanked his stars that he'd kept his work up to par and not allowed his more exciting interests to injure its quality. The rector could expel a student merely on suspicion that he was working against the government.

One Use for a Pole

AMONG the many Socialists imprisoned at this time was the editor of *The People's Voice,* a radical weekly with an unusually direct motto. "We don't

know what the government wants," it cried defiantly, "but we are against it." Of course such childishness is well known among the minor journals of democratic countries and the governments generally realize that the only effective weapon against it is the crushing bludgeon of tolerant silence. But Germany at the time was far from a democratic country. It had not learned that an active and intelligent working class needs a few such safety valves to blow off excess steam. So *The People's Voice* was under constant police espionage. In spite of its warlike motto it dared print only the mildest sort of propaganda. Its issues were confiscated without warning and the editor had tentatively tried on the martyr's crown of thorns so often that when the time came for him to be locked up he felt it was the most natural thing in the world. He didn't even fear for the future of the magazine for he had an active little pinch-hitter to carry on the work.

Steinmetz became editor as soon as the prison gates had clanged shut behind the former incumbent. He didn't know an awful lot about editing but periodicals like *The People's Voice* are non-competitive and publish themselves automatically to a great extent. Faithful comrades send in articles, news of a sort comes from party headquarters, and the rest of the space is filled with reprints from other papers of the same

political opinion. As for the technical business of make-up and proofreading, an efficient compositor can do this better than most professional editors.

Steinmetz's duties toward *The People's Voice* were not arduous or dangerous, but nevertheless he thought it best not to assume officially the title of editor. There was a university rule that students should not engage in other business while pursuing their studies. It wasn't strictly enforced but might be used against him if the police were ever able to make the rector change his mind about the outside activities of his prize student.

So Steinmetz went and got a Pole and sat him in the editorial chair. This Pole was Socialistic in the ardent manner common to Poles and he'd always wanted to be an editor. An unfortunate illiteracy had prevented him so far from realizing this ambition. He could write his name on great occasions but had never quite mastered the art of reading.

This device effectively baffled the police. They could tell without much difficulty that the Pole was not writing any objectionable articles himself and they saw no point in locking up an innocent man who was plainly looking forward to a comfortable period of martyrdom in the roomy Breslau prison. The real editor was quite invisible. Steinmetz's name appeared nowhere on the sheet, and although the

police could see him puttering around the office with a purposeful expression in his mild eyes they could get no proof that he wrote any of the articles.

Eventually, however, things came to a crisis. *The People's Voice* printed three articles which the government decided went a little too far. The police appeared in force at the office and confronted the placid Pole who was sitting in the editorial desk pretending to read and ardently hoping for a little excitement. They showed him one of the articles.

"Who wrote that?" they demanded.

The Pole smiled innocently. "I did," he answered.

The police looked annoyed. These Poles, why didn't they stay in Poland?

They thrust the paper in his face and told him to read the first sentence. Since the Pole hadn't the slightest idea what the printed letters meant he naturally couldn't do it and the police stamped out of the office with muttered comments on Socialists in general and this Polish example in particular.

Very Interesting Historical Matter

THIS ended the trouble for the present. Steinmetz, who had been hiding in the back room listening to the interview, gave a sigh of relief and turned his attention to the more pressing matter of the paper's

chronic indebtedness. Its assets were almost zero and its debts were larger than its prospects and circulation could possibly justify. Every week creditors appeared at the door in warlike moods, demanding payment for printing, for paper, and rent. They didn't worry Steinmetz very much for his own assets were very near the zero mark too, and the paper's chances for an early suppression were so exceedingly good that the slow process of forced bankruptcy held no terrors for its editor. When the printer and the paper merchant appeared one morning together in a rather uproarious state of mind he led them into the back room and suggested that they take in full payment a complete file of the paper's back numbers.

"Very interesting historical matter," he said: "quite unobtainable elsewhere."

The printer and the paper merchant walked out without seeing the joke at all and went straight to the city hall where they entered a formal complaint. A day later Steinmetz again opened the door and looked up into the unsympathetic face of a bailiff armed with an official paper sealed with a red seal. It was a formal announcement that all the furnishings of the office were attached for debt. Steinmetz smiled placidly. He soothed the bailiff as much as he could verbally, asked him to take a chair, and broke the

news as gently as possible that all the furnishings had been bought on the instalment plan and not yet more than one quarter paid for.

The bailiff scratched his head perplexedly. Plainly he couldn't attach property belonging to the wrong person. He looked at Steinmetz in doubt. Steinmetz cheerfully offered a solution. Smiling gently, he led the man into the back room and showed him the back numbers.

"All I can offer you is a complete file of this publication. Very interesting historical matter. Quite unobtainable elsewhere."

On Your Way, Comrade

THIS dubious policy of having no tangible property to attach was effective in staving off prosecution for the time being. It takes only a small difficulty to involve officialdom in a maze of red tape. While the tape mills were grinding, Steinmetz and *The People's Voice* carried on in peace as far as the creditors were concerned.

But the police had not forgotten the three objectionable articles. They were convinced that Steinmetz was the real editor of the paper and that if he hadn't written the articles he had inspired them. Slowly but surely they built up a pretty good case against him,

adding little bits of evidence here and there until they thought it would be safe to make the arrest.

In his room on Tauenzienstrasse young Steinmetz was studying away for dear life. His thoughts were far above police, paper merchants, and bailiffs. They soared in a rarefied mathematical atmosphere filled with sines and cosines, cube roots and integrals, whirling madly and thick as gnats on a summer evening. A gentle knock was heard at the door. Steinmetz didn't stir. What was a mere knock in the presence of the mathematical infinite? The knock came again and louder. Steinmetz went to the door. It was one of the comrades in a terrible state of excitement.

"They're after you," he whispered hoarsely. "My cousin who works in the courthouse says that this morning a paper was sworn out for your arrest. They're going to serve it to-morrow. You'd better get out of here."

Now the prize for excitement went to Steinmetz. He was utterly panic-stricken. Unlike his friend Lux, he'd never been able to look on imprisonment as a pleasant vacation and a golden opportunity to get work done in peace. It was a very real physical terror to his weak body. The mildest sort of physical mistreatment is a terror when you're a hunchback and not much over four feet tall.

He flew about in a panic of indecision. This warn-

ing might be a mere rumour. The air was full of threatened arrests and persecutions. But then again it might be true. He hated to leave Breslau just as he had finished his thesis and was about to receive an honourable degree from his beloved university. But if he stayed it might mean a long prison term. The authorities had been fooled once. They were probably sure of their ground this time.

When he was at the height of his panic another knock came on the door. He opened it, half expecting to see a squad of police. But no, it was a messenger boy with a sealed note.

"The police are about to arrest you for Socialist activities," it read. "They have already filed notice of their intention with the university authorities. Please destroy this note at once." It was signed, "A friend on the Breslau faculty."

That settled it. Steinmetz decided to go and to go fast. He felt safe until the next morning for unless the police suspected that their intentions were known they rarely made arrests at night. So he put on his shabby overcoat and went out for a series of last calls on his friends.

At Lux's room he found several Socialist comrades. The little group crossed the street to a restaurant for a last student party before he left Breslau. It was a quiet party and rather a sad one. But

Steinmetz enjoyed it thoroughly. He was the hero of the occasion. He was already feeling the sweet pangs of martyrdom. No one knows the height to which selfrighteousness can carry a man until he has been persecuted for adherence to some idealistic cause. Breslau looked a dark and cold city to Steinmetz now. He was about to depart to some warmer land where the sun shone more brightly on independent ideas. Where a man could be both a noble Socialist and free. The comrades approved his resolution with enthusiasm. He expanded under their praise. He almost thanked his enemies the police for so kindly breaking the ice.

Regretfully Good-bye

THE next morning Steinmetz got up early and packed in haste his few belongings. He didn't have much. Just his best suit, a shirt or two, and a couple of precious books. On the desk was a bulky pile of manuscript. This was the saddest thing of all. It was his thesis, already approved by the professors and about to be printed in the university mathematical journal. It would win him his degree with honours. There was no doubt of it.

Lovingly he gathered it up and read off the sonorous title: *On Involuntary Self-reciprocal Correspon-*

dences in Space Which Are Defined by a Three-Dimensional Linear System of Surfaces of the N*th Order.*

A trifle long perhaps but a doctorate thesis ought to have a man-sized title.

He put it away in his suitcase between two books. He'd take it with him anyway. It was almost a human friend. And perhaps he'd have some use for it sometime. You never can tell.

Now it was time to go. He went quietly into his father's room and woke the older man by touching him gently on the arm.

"I'm going away to visit a friend for a few days."

The father smiled, nodded, and went back to sleep. He never saw his son again.

Steinmetz took an early train on the railroad his father had served so humbly and so long. He was leaving everything behind him: all his hard-earned reputation in the university, all his hard-earned friends. Some men carry with them a nucleus of personal charm which they easily expand in new surroundings into a pleasant circle of friends. Steinmetz didn't even have this. He was more alone than the simplest labourer. All he had was locked up intangibly inside his big head. Perhaps someone would have use for that head and its contents. Perhaps no one would. Steinmetz smiled wistfully as he watched the Gothic

roofs of old Breslau pass by the car windows swiftly and forever.

A Conflict of Faiths

LET's say right off that this running away was cowardly and get it over with. It certainly was. All through his life Steinmetz became easily panic-stricken. The persecution of the Socialists was a rather mild one. The maximum penalty was a comfortable stay in prison involving no disgrace. As a matter of fact, in a few years the government had a change of heart toward the reformers. It granted all the immediate demands of the Socialists and remade the whole structure of the country to such an extent that when, in the Great War, it needed the support of all classes, the Socialists were as loyal as any other group.

But Steinmetz was not a true Socialist of the sort that puts the Social Question above all other matters. With him it was a theoretical devotion. He went into it more for excitement and companionship than from idealistic devotion to the Cause. Science was his real devotion and science jumps the boundaries of countries with no appreciable effort. The atoms and electrons behave just the same in America as in Germany. Volts and amperes are cosmopolitans, owing

no allegiance to any particular flag. So when Steinmetz was called upon to make a final choice between his true love, science, and his rather distant attachment to a political theory, he hopped for the frontier and began looking around for a country in which he could worship the New God in peace.

His Socialism, however, he took with him stored in an obscure corner of his mind. It was rather as if he were sworn to a religion which he didn't have much time to think about. He remained attached to it for the rest of his life because he never had time to work out anything different. Toward the end, when he was firmly established as an employee of a great capitalistic corporation, he saw the necessity for reconciling his belief with his daily practice. Then he produced a beautiful, well-oiled theory which allowed him to retain the advantages he had won under capitalism and at the same time salved his Socialist conscience.

So when he crossed the German frontier the Social Question was sidetracked for the time being. Science was the only thing which could hold his whole devotion and the tools of science were in capitalist hands. He realized clearly that science, the fruit of centuries of effort, would be the first to suffer from a period of revolutionary anarchy. By the time he reached America his opinions were such that the General Elec-

tric never felt called upon to excommunicate him for heresy.

Swiss Hospitality

STEINMETZ's immediate destination was a small town near the Austrian border where a friend was tutoring the children of a country nobleman. He didn't wish to buy a ticket direct to Prague or Vienna, for although the system of rigid passports had not yet developed there was some chance that if he crossed the border the police might get suspicious. As soon as he got to his friend's house he explained the situation and asked him to buy two tickets to a little summer resort just over the frontier. They would pretend that they were going on an outing. The friend would return that night but Steinmetz would be well on his way to Vienna.

He didn't stay long in Austria but hurried on to Zürich, where he intended to enter the Polytechnic. This institution was a Mecca for Socialist students who have reasons for preferring Switzerland to their native country. It was practically a German university and a German student might matriculate there without difficulty, but it had the advantage of being free from the interference of the German police.

One formality, however, had to be gone through with. The student had to register and this involved

showing a *Heimatschein* or certificate of residence in the city he just came from. Of course Steinmetz hadn't any, for the *Heimatschein* is hardly more than a certificate that all is well between you and the police. He tried to register without one but was rebuffed with more than usual Swiss rudeness. He was also informed that an unregistered student couldn't stay in Zürich without paying a substantial fine weekly.

Steinmetz was discouraged. He wasn't at all good at such dealings. So simple and honest were his own motives that he supposed that those of others were equally so. Of course this system of *Heimatscheins* and registrations was intended to prevent too great an influx of students like himself. There were so many German Socialists already living in Switzerland that the conservative Swiss were getting a bit worried. They wanted no trouble with their powerful and overbearing neighbour to the north and they wanted their university to be something more than a forcing bed for radical doctrines.

The very day after Steinmetz had been refused membership in the university a policeman came around and demanded the threatened fine. Steinmetz protestingly explained the situation but the policeman didn't care. Policemen don't. He renewed his demand and backed it up with a threat of immediate arrest. Steinmetz shrugged his thin shoulders and

handed over the money. These police! What a nuisance they were. Perhaps sometime he'd find a country where there weren't any, or at least where they didn't bother a peaceful scientist.

The policeman went away with the money, leaving Steinmetz very bleak. There wasn't any use trying to get a *Heimatschein*. He might write to his father to try but he knew it wouldn't do any good. And certainly if he stayed in Zürich without one his small stock of money would be quickly exhausted. You can live on almost nothing if you really want to but you can't pay a weekly fine at less than its face value.

But the situation wasn't entirely hopeless. He had a couple of letters of introduction and almost anyone will help a poor student. There's something romantically appealing about a thwarted quest for knowledge.

So by using his letters to the limit he finally made the acquaintance of a newspaper publisher who was a considerable power in Zürich. He was just the man to help him. He used influence in that magical way known only in the newspaper business. Steinmetz called again on the university authorities and was at once admitted without question. All was well at last.

By the time this long delay came to an end, Steinmetz was panting with stored-up intellectual energy. He attacked his work with enthusiasm little short of

fury. He lived on bread, sausages, and books. The Social Question, now that there was no more fascinating game of hide-and-seek with the police, was for the present forgotten. Steinmetz found that his mind had taken a great jump in the interval of inactivity. The Zürich Polytechnic began to sit up and take notice.

Rumours of a Promised Land

One of the letters of recommendation which Steinmetz had brought to Zürich was to a certain Dr. Simon, a prominent Socialist whose house was a gathering place for radical-minded students. Steinmetz presented his letter and was asked to call whenever he hadn't anything else to do. He found the host so pleasant and the company so interesting that he called as often as he dared.

One evening Steinmetz was in the corner of the room discussing electricity with another student when he heard a voice with a foreign accent talking about what sounded like a Utopian paradise beyond the sea. Steinmetz wasn't particularly interested in Utopias since the disappointment about Icaria but his own electrical conversation having petered out, he went over and joined the circle of the foreigner.

This was a young Dane named Asmussen who had

been living with an uncle in San Francisco. He was completing his education in Europe but was still bubbling over with enthusiasm for the new country. America, he said with emphasis, was big and getting bigger. There was a living for all, riches for the talented, and disappointment for none.

"What about the Social Question?" asked someone.

"Oh, that!" said Asmussen. "There isn't much heard about that. Socialists aren't suppressed but there aren't very many of them. The people haven't any grievances which amount to anything. Without something to shout about there isn't any Social Question."

This started a long argument which Steinmetz didn't listen to very carefully. He was sick of the endless wrangles about whether Socialism was the natural economic system of all society or a mere by-product of festering discontent. His vivid imagination had already carried him across the sea to a new land where there was plenty of blessed opportunity. Where the police wouldn't arrest you if you didn't think exactly as they wanted you to, and where society had empty niches in its upper tiers all waiting for anyone with brains enough to climb into them.

With the thought of this Promised Land still

glowing in the back of his head, Steinmetz carefully cultivated Asmussen's acquaintance. Like every German of the period he had thought vaguely of going to America but the thought was rather too aspiring for his far from adventurous spirit. Pioneering is all right for husky peasants and labourers. There is plenty of ploughing and ditch digging to be done in a new country. But Steinmetz's muscle power was almost nil and brains don't so easily find work to do. He needed a little information and encouragement. Dependable Danish Asmussen looked like the man to give it.

Steinmetz Makes up His Imagination

TO FURTHER his friendship with Asmussen, Steinmetz decided to give a party. It would have to be a mild sort of party, for the feeble condition of his purse didn't allow anything elaborate. Moreover it would have to be a party along decidedly limited lines. All his festivities had to be stag. Women were to him a mystery locked with a thrice-sufficient lock. Women don't appreciate a wonderful brain and a wonderful heart in only half a twisted body. So he invited three students, among them Asmussen. The refreshments were beer, bread, and sausages. The room grew thick with tobacco smoke. The four young

men grew exceedingly chummy. Steinmetz asked Asmussen to tell him more about America.

"In America," said Asmussen, "the crying need is for trained scientists."

"So?" said Steinmetz.

"The country is immense and only one quarter developed. There's plenty of money and new scientific ideas catch and run like wildfire."

"So?" said Steinmetz, thinking obscurely in the little-used practical parts of his mind.

"There's no poverty except among the newly arrived foreigners who haven't adapted themselves to the conditions, and even these are better off than they were in their native lands."

"So?" said Steinmetz, mentally inquiring about steamship rates.

"There are no damned officers strutting about and pushing you off the sidewalk. There are no damned police sticking their silly noses into your business. And there are no damned laws against talking as you please and thinking as you please. You can nominate the village idiot if you want to. Some do."

"Jawohl!" said Steinmetz, mentally buying a ticket to the new world, mentally saying good-bye to his native land, and mentally greeting the Statue of Liberty with a suitable gesture.

He was sold on America. His imagination no longer

built its castles in Germany but across the romantic Atlantic in the new land of promise. When he walked by the shores of narrow Lake Zürich he imagined it wide and stormy, with a great liner streaking across it loaded with eager immigrants, their hopes like taut rubber bands drawing it swiftly to port.

The party broke up when most of the refreshments were gone and the conversation had slowed down to a weary standstill. But in the back of Steinmetz's mind a new maggot was gnawing. It interfered not at all with the mathematical gymnastics whirling marvellously in the brain around it, but kept a firm hold on that master part of the mind which controls imagination and hope. Steinmetz already felt himself a citizen of America. He remained a Socialist—of course. To change would be treason. But he felt that he should take his Socialism off the fire and put it on ice for a while, at least until he saw how it fitted conditions in the new country he had just decided to enter.

I'll Go

STEINMETZ'S friendship with Asmussen presently became very close. Soon they were rooming together and the association proved very valuable to both. Steinmetz was a wonderful person to have around when a mathematical difficulty appeared. One snap

of his elastic mind was often enough to knock the resistance out of the most obstinate problem. And Asmussen was Steinmetz's only connection with America. He hadn't decided to go as yet. At least his whole mind hadn't agreed to the decision of its most imaginative part. He hadn't given Asmussen a hint of how his thoughts were tending. It's best to take one's time about these things.

Life went along smoothly in Zürich. Steinmetz lived very cheaply, supporting himself on the proceeds of popular scientific articles in various German magazines and spending almost nothing. Mathematics and electricity occupied his active hours, with the thought of America presenting itself subtly but alluringly when it found a loophole. The idea of crossing the ocean was still a purely theoretic one. He had no money and very small prospects of getting any.

Then Asmussen fell in love. He did it drastically with a young Swiss girl of good family. He lost all caution and wrote back to his uncle in San Francisco. The uncle replied with a scorching letter ordering him to return at once and cutting off his allowance.

Asmussen was sunk. He had no income of his own and he couldn't, like Steinmetz, support himself by writing articles. There was nothing to do but return.

The two friends were sitting together in their common room, Asmussen holding his uncle's letter

in his hand and weighing it against a mental picture of the Swiss girl. Suddenly he made up his mind. The picture faded out.

"Karl," he said to his friend, "I'm going back to America. Why don't you come too?"

"I have no money," said Steinmetz hopefully. He'd been hoping for just this remark.

"But I have enough to take us both if we go steerage. There's nothing to do in this worn-out country. You can't go back to Germany and no one but a hotel keeper can make a living in Switzerland. Think it over."

Steinmetz had been thinking it over for some time.

"I'll go," he said.

PART THREE

TURNING OVER A NEW CONTINENT

TURNING OVER A NEW CONTINENT

Unappreciated Voyage

THE French immigrant steamship *La Champagne* left its dock at Havre and poked out into the Atlantic. On the lower decks, in the steerage, was a varied crowd of future Americans. They were totally thrilled by the ocean. Most of them had never seen it before. It was just as impressive as they'd been told. They leaned out over the railing and looked ahead. Yes, the ocean was very wide. Three thousand miles, the books said. You certainly couldn't see the other side.

Up and down the crowded deck, among groups of gaily clad Italians and iron-hard Balkan mountaineers, strode Steinmetz and Asmussen. The latter was a big man while Steinmetz, of course, was very small. Four feet three inches perhaps. He walked hitchingly as if one leg were a crutch. It was an original way of walking but more effective than it looked. He could keep it up for hours.

The pair of them made a curious picture as they paced up and down the deck, swerving here to avoid

a sleeping Greek, stopping here to let four great Serbians hulk by, making a wide detour here in a sunny spot where Italian women gathered thickly, replete with crying babies.

The other immigrants observed them curiously. The Slavs laughed with naïve good nature at Steinmetz's dwarfish form. Some of the Italian women turned away their faces and hid their children. They always do that when they see anything unusual. The Evil Eye may look out of any strange face. Better be on the safe side. The old people know best.

Steinmetz wasn't taking in this gorgeous pageant of the sea. He wasn't a bit thrilled by the regimented waves marching in perfect step, all in unison to take some unreachable fortress beyond the sharp-ruled horizon. Or by the flashing white gulls twanging their sea cry overhead. Or by the porpoises, three or four, appearing and disappearing like Neptune telling his beads with a living rosary. He didn't see these things at all. His mind was too specialized, too largely magnifying. It's a great misfortune to observe those white gulls and think of the aërodynamic forces holding them up. It's a shame to realize that porpoises are made into oil for Swiss watches.

Scientific minds, the greatest ones and the best like Steinmetz's, are like twenty-power binoculars. You look at a beautiful view, a stretch of forest, a bit of

the sea shining a long way off, a house and barn perhaps. Then you take the binoculars and find yourself inspecting close by a cluster of ash heaps, a row of cabbages, or three quite ordinary oaks. These may be useful in themselves and may never have been properly observed before, but there's no joy in the view any more. It's too much as if you knew all its secrets.

So when Steinmetz looked over the side of the ship or out of a car window his mind was merely resting for a renewed offensive. He was never conscious of the stream of interesting things going by. When he did see something it was apt to be superimposed on a close pattern of mathematical symbols. He was never conscious of beauty in any of its forms. Beauty was too vague, too general for his specialized mind. He couldn't appreciate at one time all the subtly associated conventions which make a thing beautiful to us. Unless it offered definite intellectual fodder he cast it aside as perhaps interesting, but not a part of his world.

So Steinmetz and Asmussen paced up and down the deck talking electricity while all the pageant of the sea and of varied humanity cast upon the sea went parading gorgeously past them. These Italians, Greeks, and Slavs were people of no country. They were about to gain one. This sharp-pointed steam

universe was taking them to the New World where they'd rattle around inside a vast empty continent, make their fortunes, and found the first families of the future. Steinmetz was also a citizen of no country. He belonged to the Brotherhood of Science. He had sworn the oath of membership, "Thou shalt honour no God but truth," and was taking the whole thing a little too seriously. The Italians, Greeks, and Slavs were much more excited by the approach of the New World than he was.

Harbour of Refuge

THE Statue of Liberty! To see her costs a New Yorker only a five-cent ride on the elevated. It costs an immigrant his money, his friends, his home, and his nation. He will have to start all over again in a new country. But by the time his ship has reached New York the immigrant has become reconciled to the loss of the old country and is looking forward to the approach of the new.

The immigrant has known this statue all his life, has seen it on the posters of steamship companies, has heard it talked about by friends with relatives in America. Now he sees it for the first time, standing grave and impressive, green bronze on a granite base. Behind it the towers and shipping of New

York. All about it a broad bay shining in the sunlight, and criss-crossed by the wakes of ships. Look hard, immigrant. This isn't a sight you'll see twice. What do you think of your new country?

To Steinmetz the voyage itself hadn't meant much. It was pleasant enough with so many people around but it hadn't aroused anything in him, for it hadn't any intellectual ideas mixed up with it. Just beauty and novelty, that was all it was, and he knew nothing of these. So all the way over he talked electricity with Asmussen, who didn't talk it very well.

But the first sight of the Statue of Liberty was a very different matter. Here was the greatest symbol in the world backed up by the city, the country, and the continent where he'd make his fortune. He looked carefully and minutely at the ships. They were very impressive, so many of them and so large. He looked at the growing knob of high buildings near the Battery. They weren't big enough then to be called skyscrapers but they looked pretty tremendous to Breslau eyes. So Steinmetz smiled up at Asmussen and complimented him on his choice of a country. Things looked pretty bright as the ship steamed slowly up the harbour and docked a little north of the Battery.

The first- and second-class passengers were allowed to go ashore at once but the immigrants in the

steerage had to wait for two days until their ship got its turn at Castle Garden, which was the Ellis Island of the time. During these two days Steinmetz got a bad cold, which made his face swell up grotesquely. Not very attractive at best, he looked worse than usual. His eyes, the feature of his face which made up with their intelligence and kindliness for his defects, were swollen almost shut. In this condition, with an empty purse, with very little English, with only one friend, he went before the immigration officials.

"Your name," snapped an abrupt and disagreeable man.

"Karl August Rudolf Steinmetz."

"Profession?"

"Mathematiker und Forscher."

"Money?"

Steinmetz was silent, acutely conscious of his utterly empty pockets. The official frowned and wrote something down in his notebook.

"Speak any English?"

"A few."

"No English," the official snapped, making another entry in his notebook.

"Have you any job?"

Steinmetz didn't understand and Asmussen translated.

"Nein," said Steinmetz finally.

The official waved his notebook toward his superior who was standing behind him. The latter gave it a casual glance.

"He can't speak English," said the first official. "He hasn't got any money or any job. He's sick and deformed."

"Can't come in," said the second official, turning away and talking to a pretty Italian girl who was next in line.

"Detention pen," said the first official, pointing to a huge sign which bellowed hated words in a dozen languages.

Steinmetz shrank with dejection. He felt his hope and courage running out of his feet like sawdust out of a rag doll. His eyes closed and his swollen face became hardly a face at all. Half conscious he waited, unable to accept the verdict, but also unable to make any move in his own behalf.

Half conscious he heard Asmussen, his strong, almost American friend Asmussen, interceding for him with the higher official. This worthy applicant, said Asmussen, was a well-known scientist. He had no English, to be sure, but he'd learn it quickly, as he did everything else. He had plenty of money. Here it was. Asmussen pulled out a bulky roll and swore that it belonged to Steinmetz. And furthermore, he said in fluent, emphatic English, he would personally

see that his friend would not become a public charge. He had lived in America before. He had plenty of jobs, a profession, and an uncle.

The official relented. He motioned to Steinmetz to proceed. After all, he thought, America needed brains more than it needed muscles. And the Serbians already admitted that day would suffice to dig a thousand ditches. He felt very broad-minded and virtuous as he watched the reputed great scientist and his big Danish friend walking out under the trees of Battery Park.

Make Your Bids, Gentlemen

STEINMETZ and Asmussen walked out into the qualified sunshine of Battery Park. The smoke pall hung as usual over the city but still the scene looked very cheerful to their eyes. They observed with happy interest the squabbling English sparrows, the sprawling elevated structure, and the little excursion boats moored against the sea wall.

"This is my country now," thought Steinmetz. "I shall love it. In fact," he corrected himself, "I love it already."

It was Asmussen's plan for them to stay in Brooklyn with relatives until they found jobs. They crossed

the East River on the little ferry which still ran under the shadow of the newly opened Brooklyn Bridge. Steinmetz looked up at this graceful structure with delight. He could hardly take his eyes off it. All the way over he rejoiced in its mechanical perfection, and visualized the forces running through every little cable and truss. This was the way to build a bridge—no clumsy masonry such as they used in the Old World.

After a week with Asmussen's relatives, Steinmetz felt that he had enough English to cope with the great city. So he sallied out, crossed the river on the bridge, and landed again on Manhattan. He had a great desire to get acquainted with his new country. He didn't dare think of applying for a job yet. The strangeness of it all confused him. The language was still little more than a meaningless noise. The people acted unaccountably. Too bad they didn't speak German, then he'd know what they were thinking about.

It wasn't long before he got enough English to find his way around. Learning as simple a thing as a language was child's play to him. He had to be told a word only once to remember it forever.

He had brought a number of letters from Zürich and he felt he knew enough English to present them.

He hoped, too, that some of the men would know German. His best letter in his estimation was to the head of the Edison factory. Although Steinmetz didn't think much of him as a scientist, Edison had captured his imagination. He felt honoured to have a letter to one of his subordinates.

There was no position open at the Edison works. The head engineer read his letter through quickly, without more than glancing at the hopeful little man who presented it. Before he had half finished, it was obvious that he wasn't going to give Steinmetz any job. To appreciate Steinmetz, you had to look at him with imagination, and most of all you had to hear him talk. The engineer gave him a quick glance or two, wouldn't listen to his halting copybook English, couldn't understand his German, and waved him out of the office.

"There are too many engineers coming to America now. We don't know what to do with them."

Steinmetz walked regretfully down the steps. After all, this was what he'd expected. It took a person of sharp penetration to appreciate his intelligence. Brains are so easy to cover up with old clothes and unattractive flesh.

"And I've no doubt," said Steinmetz humbly and forgivingly, "that there really are a great many engineers coming to America."

Sprechen Sie Deutsch, Bitte

THE next morning Steinmetz journeyed up to Yonkers to see Rudolf Eichemeyer, manufacturer of hat machinery and electrical devices. He entered the office in high hopes. This man Eichemeyer sounded like a good German. Perhaps he'd be able to speak his own language. Steinmetz had learned that when he got to talking freely he was most sure of making an impression.

He was greeted by a suspicious young man who, Steinmetz could easily see, was observing his clothes, his deformity, and his accent more closely than the eagerly proffered letter of introduction. When he asked to see Mr. Eichemeyer he was told that he was upstairs and busy, but would presently be down. Steinmetz sat and waited. The suspicious young man watched him for a while and then went out of the room.

In a few minutes there came the sound of someone coming downstairs. In the door appeared the imposing figure of a tall, bearded man. He smiled, came toward Steinmetz, and put out his hand. Steinmetz felt that here at last was a friend.

He stammered a little and said formally in his theoretical English, "I presume that I have the honour of speaking to Mr. Rudolf Eichemeyer."

The tall man with the patriarchal beard and the smile nodded his head. Then came the blessed command, "Speak German please." Those four words, *"Sprechen Sie Deutsch, bitte,"* were the pleasantest Steinmetz had heard since he landed at Castle Garden. With almost a whoop of joy he launched into a flood of technical German, overwhelming Eichemeyer with details of electrical developments in Europe, spouting mathematics like a geyser, until the older man was completely convinced that here was a distinct find. They talked for two hours before the interview came to an end. Then Eichemeyer rose and said that, although unfortunately he couldn't give him a position at the present time, he was very much interested in him and would let him know if there was ever any opening. He also dropped a hint that it would be a good idea to come up to Yonkers in about a week.

Steinmetz boarded the train for New York in a very cheerful state of mind. He had no sure job as yet but he knew that he had made such a strong impression on Eichemeyer that there would be a place for him very soon.

When he returned promptly at the end of the week there was a job ready for him. He was to be a draughtsman at twelve dollars a week, not a bad

WITH HIS FIRST U. S. PAPERS AND TWELVE DOLLARS A WEEK

starting salary for those days. Certainly enough to live on.

Buoyantly Steinmetz left the office, almost skipping for joy. He was to begin work the next day. He was actually a self-supporting American. And only two weeks after landing. Certainly he had a lot to be thankful for.

Then he had a sudden inspiration. Instead of going to the railroad station he hunted up the court-house and took out his first naturalization papers. This was the least he could do for the country which had treated him so well.

Twelve-dollar Self-sufficiency

On his first working day Steinmetz got up rather too early in the morning, crossed over to Manhattan on the ferry and went up to Forty-second Street on the elevated. He looked out with benevolence upon the city in which he had now a regular part interest. He took the New York Central to Yonkers and from the train looked out with delight on the open country which is now the Bronx. It was his country. He owned a part of it and was about to help its wheels to revolve.

His enthusiasm made the work at Yonkers a delight. His mind was more unfettered than it had

been since he left Breslau, for now he was working on definite problems toward some recognized end. Steinmetz didn't like to worry about such non-essentials as passports and immigration regulations. They were too trifling and purposeless. But when a god like Rudolf Eichemeyer wanted to improve a machine and told him to see what could be done the procedure was direct and stimulating. He just went ahead and improved the machine. There was no uncertainty, nothing to worry about. The laws of mechanics are much more just than the laws of humanity. And at the end of the week came the twelve dollars—quite enough for a man who wanted nothing but to live and let his brain loose on the most obstinate problems in sight.

The Eichemeyer plant was not very electrical at that time. It was concerned largely with the manufacture of a hat-making machine invented by the owner. This was the mainstay of the business. Eichemeyer himself, however, regarded the improvement of electrical apparatus as his chief interest. He put Steinmetz more and more on this sort of work.

In those days the electrical industry was in a very crude and formative stage. It hadn't yet come into its own. Arc lamps were seen on some streets and cities were building generating plants but the whole business was in an experimental state. Out in Menlo Park

Edison with cheerfully unscientific energy was carbonizing innumerable substances to try and make a practical incandescent lamp. He tried silk, cotton, wool, and paper. He plucked a red hair from the beard of an assistant. After countless failures the incandescent lamp finally took form. And out of it grew a new demand for electrical apparatus.

All over the country men were trying blindly and with little theoretical knowledge to construct better generators and transformers. The method they used was to make a new one slightly different from the others. If it got too hot or showed too low efficiency it was discarded and the attempt made over again. If it worked there was great rejoicing and the company's stock took a jump.

This method didn't suit Eichemeyer, and it didn't suit Steinmetz. There was mathematics in those coils of copper wire and those exasperating blocks of soft iron. If possible they proposed to extract it and put it down on paper where it would work for them. There's nothing like mathematics to do your work for you. If treated understandingly it never makes a mistake.

So, interwoven with the prosaic business of making and repairing the felting machines, was more and more electrical work. With fumbling pencils Steinmetz and Eichemeyer planned new motors for new

purposes. No one knew the rules. Their guess was as good as anybody's. Often it was a good deal better for Steinmetz was getting certain theories into shape. People in high places outside of Yonkers began to take notice.

Home and Recreation

THE main trouble about working in Yonkers was the long trip from Brooklyn. It meant getting up at five o'clock and travelling for two hours on horse cars, ferry, elevated, and railroad. It was expensive too. So when Asmussen also got a job in Yonkers, Steinmetz rejoiced exceedingly. The long journey twice a day was exhausting and annoying but he wouldn't have left his only friend for any amount of gain. Steinmetz clung to friends tenaciously. They meant more to him than they did to others. He never reasoned very clearly on the subject but he realized vaguely that his deformity would never allow him to enjoy a very full and naturally varied life. Such social enjoyment would have to come vicariously, in little chance bits through his friends. So he clung to Asmussen like a leech, helped him in every way he could, and saved an astonishing amount out of his twelve weekly dollars to pay him back for the passage money.

As soon as Asmussen got his job the friends moved

to Harlem and set up a sketchy sort of housekeeping. It didn't amount to much. They shared a large room and cooked two very simple meals a day. Sometimes Steinmetz would take his lunch to work with him. In that case there would be no coffee for the later-rising Asmussen. Sometimes there'd be wordy arguments about who should do the dishes. Steinmetz enjoyed these arguments very much. They were social life to him. He wouldn't have objected to ten times as many dishes if he'd thought that Asmussen really wanted him to do them, but he liked this sort of inconsequential wrangle. If he'd had a proper audience he'd have played practical jokes, but these aren't any fun if you haven't someone to laugh with you at the victim's annoyance.

This bachelor establishment was completely satisfactory to Steinmetz. It filled all his simple wants. There was a place to sleep, a sufficient amount of food, and someone to talk to when he came back from work. Of course Asmussen wasn't there all the time. Then Steinmetz would take out a weighty mathematical work and read it as one would a novel. Next to talking to a pleasant friend this was what he liked to do best. The characters in a mathematical treatise are so wonderfully honest. They don't do insane, unaccountable things. They don't fall in love. They don't have fits of rage. They aren't a bit superstitious.

He felt very much at home among them. He loved to see them moving sensibly and evenly according to a set of complicated but quite definite rules. Sometimes he wished he were one of them. Then he could live in a way he understood, and move simply and evenly according to a rational set of rules. In his dealings with other people he'd never have to worry about motives and emotions which he never felt in his own heart.

The Third Harmonics

WORK at Yonkers became more interesting day by day. The hat machinery receded gradually into the background and electricity triumphantly took its place. Eichemeyer had the gift of economic prophecy. He saw that hats would remain hats but that electricity would become the bone and sinew of the country. So he took his new little draughtsman, the curious little German whom he didn't a bit understand, and set him down with pencil and paper. He told him to play around with electrical laws to his heart's content. No more hat machines for the man who could make all mathematics jump through the hoop.

Steinmetz amused himself greatly and his brain speeded up as it never had before. There was such a wonderful lot to learn. Such a gorgeous lot of truths

all ready for the telling. He soon found that his knowledge of the subject far outran any printed data about it so he had to find his own data before he went any farther. This was his first electrical research. Eichemeyer was delighted with the way he went about it and helped him as much as possible. Slowly a great general law took form in his labouring mind. It wasn't complete yet and Steinmetz would say nothing about it. He wished to have it unassailable before he let it out to the world.

As soon as Steinmetz had learned a little working English and gained a small nest egg of self-confidence he joined the American Institute of Electrical Engineers. The meetings gave him the most intense delight. He loved to pit his wits silently against the greatest electricians in New York. As yet he didn't venture a word of his own. He was too much afraid that his English would play him false and make him ridiculous. But with increasing fervour he made mental objections, silently drove holes in the symmetrical hypotheses of the older men, and leaped inwardly with joy when he saw that some well-considered mind had slipped a cog.

Eventually, of course, his eagerness got the better of his diffidence. A meeting was drawing to a close. All the evening Steinmetz had listened with anguished fidgetings to a long paper by Thorburn Reid on "The

Armature Reactions of Alternators." To his mind the theory was incomplete. It did not consider the third harmonics. This was worse than being merely wrong. It was an insult of silence to the great God of Science himself. Reid must know all about third harmonics. Of course he did. And if he did know about them, and still left them out, the omission was almost treason.

Finally the tension grew too great. Reid committed a particularly awful crime. He left the third harmonics out where a complete idiot would see they had to go in. Steinmetz rose out of his seat in the back row and raised his hand like a schoolboy.

"The third harmonics," he shrilled in his high voice. "Vell, vere are they?"

The audience turned around to have a look at the objector. Then they turned back again. It was just the little dwarf, noticeable only because of his physical peculiarity. The speaker looked up with an expression of annoyance.

"If the third harmonics were considered," he replied with dignity, "the theorem would be much too complicated. It would make a great deal of trouble without doing any good. Also I doubt if it would be possible to work it into any understandable form."

Steinmetz said nothing. His feeble English forbade

any effective reply but he was boiling with scientific indignation. Not include the third harmonics because it was too much trouble! The very idea! What was mathematics for if not to tame such fractious beasts as third harmonics? He, Steinmetz, would show what he could do. No third harmonics could terrify him.

Quietly he went back to Yonkers and set to work to complete Reid's theorem. The third harmonics were certainly hard to deal with, but slowly they grew more manageable. And they really were very necessary to the completeness of the theorem. It took him more than a month to get the theorem in presentable form with all the possible flaws closed up. Then he copied it out in his small, printlike handwriting.

He read the paper at the next meeting of the institute. It was a great success. Electricians young and old congratulated him on solving a particularly nasty problem. And best of all, Reid came up after the meeting and thanked him for dealing conclusively with a point which had given him so much trouble.

Steinmetz left that meeting feeling very well satisfied. His nest egg of self-confidence grew to quite hefty proportions. He had made a sizable dent on the mind of the institute and Reid was not angry with him for doing it. All in all, things were going pretty nicely.

Let Me Introduce You to Hysteresis

THE episode of the third harmonics gave Steinmetz much increased belief in his own abilities. Eichemeyer heard about it, too, and put him on more important work. Now he was designing a motor for use in a rudimentary street car; now he was calculating the magnetic flux in field coils; now he was worrying about the constants of a transformer. It was all very interesting. He used the most modern tables and theories. Every now and then he'd come across something which made him stop and think. Perhaps he'd jot down a note or two in a very special separate book. His first great discovery, called the Law of Hysteresis, was taking form in his mind.

Hysteresis is a difficult-looking word. Even electricians pronounce it in a variety of ways. But it stands for a very simple thing. When a bar of iron is placed inside a coil through which a current is flowing it becomes magnetized. Like the compass needle, which is nothing but a magnetized bit of steel, it has a north pole and a south pole. When the current reverses the poles change places. They do it promptly in soft iron, slowly in steel, but in no metal do they do it instantaneously. This delay is called hysteresis. It is very important.

Most electrical machines depend for their action

upon magnetized iron. It is possible to have magnetic flux, the desired force, without using iron, but it is not so strong or easy to control. Motors, generators, and transformers accordingly have an iron core. In alternating-current machines the direction of the magnetism changes with each reversal of the current. Since this usually occurs 120 times a second it is easy to see that the speed with which the iron core is able to do an about-face is exceedingly important. If the losses due to hysteresis are too high the machine may become red-hot. At any rate the efficiency drops to an impractical level. One of the chief problems of the electrical engineer is to calculate this loss and plan to avoid as much of it as possible.

When Steinmetz began his work at Yonkers there was very little known about hysteresis. Certain tables had been published but they disagreed among themselves and didn't pretend to be more than experimental data. There were many cases where they couldn't be used at all.

About the time Steinmetz came to him, Eichemeyer invented an ingenious device which he called a "magnetic bridge." It was used to measure the magnetic properties of various kinds of steel and iron. As soon as Steinmetz was allowed to use this apparatus he saw its great possibilities for the advanced study of magnetism. He spent long hours

after work experimenting with all sorts of metal and all sorts of current. Eventually he began to see the vague outlines of a fine upstanding generalization which, if perfected and proved, would be a tremendous help to anyone designing electrical machines. He dug into the problem ferociously, forgetting to eat, to sleep, and almost forgetting to light his cigars.

As the theorem became clearer, was brought into sharper focus, Eichemeyer used to look over Steinmetz's shoulder and pat him on the back for his cleverness. Then he used to pat himself on the back too for recognizing a genius in the unprepossessing little immigrant who had presented himself so timidly at his office door.

Such Is the Kingdom of Heaven

STEINMETZ and Asmussen lived together for some months. At the end of that time Asmussen was able to send to Switzerland for that same young woman who had caused his break with his uncle. They were married duly and went to live in the Bronx. Of course they asked Steinmetz to live with them. He was such a home-loving body and so dependent that they couldn't have done otherwise. It would have been like moving away from a summer house and deserting the most recent kitten.

But Steinmetz knew when an invitation was half genuine and when it was entirely not so. He said that he preferred to go to Yonkers where he would be nearer his work. So the newly married pair crossed the Harlem to domestic obscurity, and Steinmetz packed up his scanty belongings and went to live with the family of a certain Mueller who was draughtsman for Eichemeyer.

This new home turned out to be better than he'd hoped. The Mueller family was a large and uproarious one. Just the thing he loved. There were apt to be guests in the house and the dinner table was a long way around. In the moments when hysteresis, magnetic circuits, and inductances were far from his mind, Steinmetz would romp with the children as if he were one of them. Indeed he almost was. Except for that capacity for abstract thought, lodged miraculously in his big head, he remained a child all his life. And children recognized this. As soon as they got used to his peculiar looks they made him one of them, let him join in all their games, and found that he was as fond of horseplay, practical jokes, and make-believe as any one of them. Sometimes a thought would take him in the midst of the excitement. Then he'd run for his pencil and his logarithms. His mind would leave the children for a time and ascend to heights where even their almighty fathers

couldn't follow. The children would go on with their play, running madly shrieking around the table where little Steinmetz sat working out some intricate problem. When it was done he'd fold up his work and soon be shrieking as gaily as any.

"A little child shall lead them," said a biblical person a long time ago. With certain reservations he knew what he was talking about.

The First Whispers of Fame

All this time the Law of Hysteresis was taking form and coming into focus. Soft iron and hard steel were giving up their secrets before a mind which penetrated so deeply and divined so clearly that their most hidden properties lay flat and helpless on the surface.

Now it was almost time to publish. Carefully and fearfully Steinmetz went over and over the whole thing. No smallest flaw should be passed by. No minutest crack should admit the entering wedge of criticism. He didn't care much for his reputation. He had little to lose. But to his mind a problem done incompletely was worse than a problem not done at all. Better to be a good draughtsman, or even a good scrubber of floors, than a sloppy scientist. So he polished his theorem, rubbed it down with the sharp-

toothed comb of searching tests. It would have to be well groomed to appear in full glory before the American Institute of Electrical Engineers.

On January 19, 1892, the great paper was read. It was a stormy day. Steinmetz wore his rubber overshoes and turned up his trouser legs to keep them dry. His English wasn't much. It never did become pleasant to listen to. But he bravely got up on the platform and began reeling off equations and propositions. The audience was first interested, then enthusiastic, then spellbound. Many of them didn't understand a word he was saying. It was over their heads. A few could follow him and these applauded loudly. The rest realized the importance of the discovery and applauded a little later but just as loudly. There was something about the twisted little man up there alone on the platform, something about his intensity, his seriousness, and his abounding command of his subject, which inspired great respect. Steinmetz was no dwarf when he got to talking and you could meet him brain to brain.

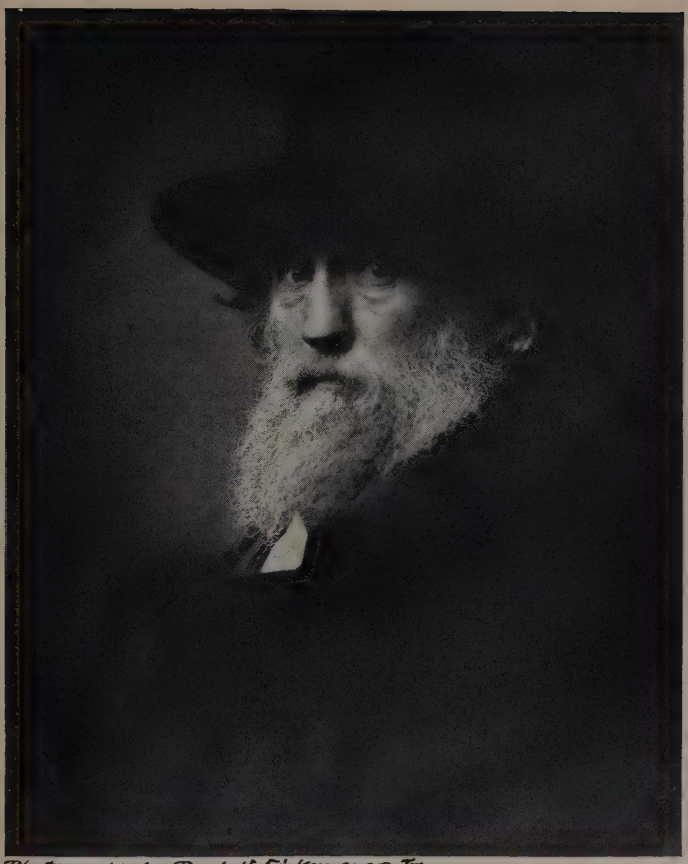
The public reading of a complicated scientific paper is a mere formality. Few papers can be understood in the time afforded by a reading. The subsequent publication gives a better opportunity for study and testing. But even before publication this paper was recognized as important. If the theorem did what it

claimed to do, and somehow no one had any doubts after hearing Steinmetz, it would take a great deal of the uncertainty out of electrical designing. Many an engineer heaved a great sigh of relief when he heard the good news. No more grilling on the carpet when an expensive machine got too hot and burned out the insulation. No more fooling with costly models which worked beautifully until you tried to expand them into practical sizes. Electricity took a long stride forward that stormy evening.

The Law of Hysteresis was published presently and of course was assailed by the usual criticism. Engineers had been saying so many years that it couldn't be done that they were unwilling to admit that it had been. But Steinmetz weathered the storm. In another paper he routed all his attackers. His theorem was accepted and soon was being used in every designing room. At the age of twenty-eight he took his place in the front rank of engineers. Eichemeyer formed the custom of inviting him to dinner.

A Revolutionist Aristocrat

DINING with the Eichemeyers was an upward step for Steinmetz. They were a leading family in Yonkers. Eichemeyer was a considerable manufacturer and had in addition quite a reputation as an



Photograph by Rudolf Eickemeyer Jr.

Yours Truly

R. Eickemeyer

RUDOLF EICHEMEYER, REVOLUTIONIST
AND PATRIARCH

inventor. His hat machinery had caused a real revolution, if an overturn in the hat industry can be called by such a name. Just now he was branching out into the field of electricity and was meeting with great success. His "iron-clad" dynamos were the best made at the time. He was associated with Otis Brothers & Co. and their first successful elevator motor was developed in his plant.

Eichemeyer had left Germany for the same reason as Steinmetz. When the Revolution of 1848 was suppressed by the Prussian troops Eichemeyer was a student in Munich. Like most of the students in the university, he was involved actively in the revolt. When the trouble was over the authorities promised that all the rebels would be forgiven. But it didn't take as clever a man as Eichemeyer to see that such wasn't likely to be the case. He slipped over the Swiss border as Steinmetz had done and came to America, where his great abilities soon raised him to the top. He was tall and straight and handsome, with a white beard and a patriarchal disposition. He lived in a large brick house on a hill. He was known for hospitality and generosity. It's strange how these German revolutionists become aristocrats as soon as they meet with good fortune in the New World. Steinmetz did the same thing in a somewhat different way. He could never become patriarchal in every

respect. He didn't look the part, and he didn't have any children. But toward the end of his life there was no more contented and mellow person than Steinmetz. Things were going pretty well. The world was getting better all the time. The Socialist Utopia was coming, no doubt, but certainly there wasn't any need of hurrying it up. Steinmetz and Eichemeyer could have shaken hands across the thirty years.

So Much Is in a Name

SUCCESS made a deep psychological change in Steinmetz. He no longer felt himself to be a feeble flutterer on the outskirts of society. Great men praised him. Important engineers at a distance wrote to him asking advice. In the growing world of electricity he was now a large personage standing upright on the inside, not a timid gnome peeping fearfully in through the lighted windows. Karl August Rudolf Steinmetz was a name which meant something. He began to look critically at this name. Somehow it seemed too German. And Germany was the country which hadn't appreciated him.

One day, soon after the great evening when he read his paper on hysteresis, the unsuitability of his name was brought sharply to his attention. He was signing a receipt for wages while a German friend

looked over his shoulder. As he wrote down the four very Teutonic names the friend pronounced them as they would have been pronounced in the old country. A true German can make any word sound German, but these names can be made as German as the Rhine or sauerkraut. Steinmetz didn't like to hear them this way.

Without looking up, he tore the receipt in two and wrote out another. The friend made no comment until he came to the signature. Steinmetz wrote the first name, spelling it "Charles." Then came a short pause while his mind skipped the habitual two middle names. Then he set down the last name. The friend made some slight comment, which Steinmetz took as a rebuke.

"I'm an American now," he cried, holding up the paper and reading off the signature in as good American as he could manage. "And my name shall be American too."

The friend laughed. It was all very silly business.

"You haven't any middle name yet," he said derisively. "All Americans have middle names."

It was true. Steinmetz looked doubtfully at the signature. It certainly didn't look right. There ought to be a middle initial, and that middle initial would have to stand for something more than just a name added for looks. He couldn't use either "August" or

"Rudolf." They were too German far. What could he do? He hesitated. It was the kind of dilemma which his scientific training couldn't help him to solve.

Just then a knock came on the door and a young German entered whom Steinmetz hadn't seen since Breslau days. When he spoke he used the old student name, "Proteus."

Steinmetz was glad to see him but shook his hand with obvious inattention. He was itching to get at a new sheet of paper. As soon as he possibly could he scribbled out a new receipt and signed the name "Charles P. Steinmetz."

"There," he cried, waving it triumphantly. "Now I have a real American name. I'll be getting my second papers soon. Then I'll be a real American."

He looked at his German friend, who didn't sympathize.

"You stay in America for a while longer and you'll want to be American too."

G. E.

THE 1890's were years of industrial travail. America was feeling its strength. Industry from its birthplace in New England had spread over the country, draining the youth and enterprise from the farms and compressing it into the new manufacturing cities.

The bogey word "trust" was written large on the wall. Carnegie and Rockefeller were gathering their hundreds of millions. The railroads were ravening wolves of finance—very different from the timid public utilities we condescend to ride on to-day. If an industrialist were idle for an accidental moment he was apt to take a pencil and write down sweeping tremendous sums across the page of a notebook. Then he'd look at the result and shiver and wonder how he dared to do it.

At this time the electrical industry was still largely experimental. Edison was up to his tricks, trailing after him a marvelling crowd of the curious who gaped at the new incandescent lamps at Menlo Park or poked their heads into his power houses to listen to the hum of the dynamos. Street cars were beginning to run without horses. There was talk of subways. People began to think lovingly of the future when electricity would take the annoyance out of kerosene, the danger out of gas, and perhaps later the smoke and soot out of railways.

A new-born industry is apt to remain for a time under the control of inventors. This was true of electricity. Most of the companies manufactured the devices invented by their founders. Eichemeyer, Osterheld & Company was a good example. Hat machinery and transformers don't naturally go to-

gether. It just happened that Eichemeyer was interested in both. This helter-skelter way of doing things is bad for an industry. A new and greater directing force was badly needed—an organization which would make all kinds of apparatus, from dynamo to light bulb, and exert some sort of control over the development of the industry as a whole.

While Steinmetz was working on his Law of Hysteresis certain far-sighted leaders of electricity had formed such an organization. It included all branches of the industry and outranked everything else in the field. Its capital was greater than anything hitherto projected and every effort was made to have it control the most important patents and the best scientific brains of the time.

In 1892 the Edison General Electric Company and the Thompson-Houston were merged to form the General Electric Company. It had a capital of $35,000,000 and a mighty supply of prestige. Part of this prestige was gained by acquiring Steinmetz, the rest of whose life story is written on a General Electric letterhead.

Buying Unborn Patents

THE first thing the new General Electric Company did after its formation was to look around the world

for those patents which it needed to complete its control of the electrical situation. Some of the essential ones belonged to Eichemeyer. So presently an officer of the General Electric appeared in Yonkers to interview Eichemeyer and arrange to take over his company.

Now this man, E. W. Rice, later to become president of the company, had something else on his mind besides the patent situation. It was the opinion of Mr. Rice's superiors that Eichemeyer's young engineer Steinmetz was worth more than all his patents. A patent after all is just one patent, while a great mind may contain a dozen patents inside it. The General Electric was far-sighted enough to realize this.

The first sight of Steinmetz was always a shock to a stranger and Rice was no exception to this rule. He was admittedly startled and disappointed. The man looked hardly remarkable, certainly not a genius. But luckily for both Steinmetz and Rice the interview didn't end there. Steinmetz had a chance to talk. He talked rapidly and precisely. He talked of electricity, of mathematics, of physics, engineering, and chemistry. He knew a good deal about all of them and all about some of them. As he talked he smiled happily. This was what he loved to do most. Rice sat listening.

He came very soon to the conclusion that this bacon was worth bringing home.

So when the time came to close the deal Eichemeyer found the bargaining much easier than he'd expected. The General Electric men saw his point of view most readily. They didn't kick too much about the price. It was so easy that Eichemeyer was mystified. He had expected a lot of trouble. Then suddenly he saw the light. One of the clauses of the contract was that he should persuade Steinmetz to go with the General Electric. Eichemeyer laughed to himself. This gang certainly was thorough. It was buying not only his grown-up patents but the unborn ones still in the brain of his little engineer. So Eichemeyer pocketed his profits, realizing well that they would have been much smaller if he hadn't recognized genius in the eyes of the frightened little German three years before.

Steinmetz didn't like the idea of going to Lynn with the General Electric. "Chance for advancement" was a phrase which meant nothing to him. But Eichemeyer had told him to go and that was enough. In his mind the matter was already settled. He never thought of deserting the ship just because it had a new owner. He was as much a part of the company as the file cabinet or the trade-mark, and about as likely to desert. He would have more oppor-

tunities, more contacts, and eventually more money. But material considerations never weighed very heavily with Steinmetz. He really wanted only two things—friends and a chance to work in peace. Later on he came to love praise and publicity but that was not yet. For the present he wanted to work all day feverishly on the problems which fascinated him and then come home at night to a group of friendly people who were used to his looks and could take him into their midst without awkwardness. Such a job was his at Eichemeyer's and such a family group was his with the Muellers. No wonder Lynn seemed a cold and lonely place.

After an almost tearful parting from Eichemeyer and the Muellers he went to Lynn and took a dreary room in a none-too-pleasant boarding house. It seemed pretty terrible at first but gradually he learned to like it. When the time came to move again he was as unwilling to leave Lynn as he had been to leave Yonkers. The home instinct was so strong in Steinmetz that he would have learned to love a prison cell if the keeper had let him use a pencil and paper.

High Finance

A STORY is told about Steinmetz at Lynn which, true or not, illustrates very aptly his peculiar tempera-

ment. A friend who had known him at Yonkers came to see him soon after he moved. He found him in a sad state. His room was the smallest possible to find and his clothes showed frantic signals of distress. His face looked pinched and thin and he had lost a good deal of weight—which for a person of his build and precarious health was a serious matter. The friend lost no time in discovering the trouble. It wasn't easy to get personal problems out of Steinmetz. The sensitivity bred of a lifetime of deformity catches the quick complaints before they reach the tongue. But at last the friend found out.

By some mistake of a clerk Steinmetz's name had not been entered on the pay roll. He had received no money at all in the four weeks he had been at Lynn. His own small savings had nearly run out and he was too proud to make a complaint. There were men at Lynn who were working for nothing, glad of the experience which the job gave them, and Steinmetz, whose self-confidence at this time was a very wavering factor, had supposed that he too was in this classification. He was hoarding his funds in the hope that he could last out until his salary was at least raised above zero.

For a week or more he had hardly eaten anything; his room rent was unpaid, and in the intervals when his mind was not filled with thrilling electrical prob-

lems he was worrying himself sick lest his fragile body might suddenly snap under the strain. But so sensitive was his spirit he didn't dare inquire at the main office for fear that some officious clerk would look up his name in a great book and tell him that, far from expecting a salary, he ought to be glad to be allowed to work for so mighty a firm as the General Electric.

But just sit still, little Steinmetz. Let the symbols spin happily and freely in the depths of your brain. Your salary will be raised as high as you ask. Handsome men in high hats are waiting in the future to bend down and shake your hand. The presses of numberless papers are waiting for your opinions and will spread barrels of ink on acres of newsprint to publish the faintest shadow of your least considered thought.

St. George Picks His Dragon

THE work at Lynn wasn't very strenuous. At least not strenuous compared with the research work he'd been doing for Eichemeyer. His first job was to go over the transformers made by this new company and see if they could be improved. Eichemeyer's transformers had the reputation of being the best in the country, and since Steinmetz was largely responsible

for this, the General Electric saw a chance to cash in on their investment. They hadn't bought out Eichemeyer for nothing.

The work with the transformers was extremely important both to Steinmetz and to the industry. By this time all electrical men who didn't have business reasons for thinking otherwise realized very well that if the industry was to expand it would have to adopt alternating current. And alternating current requires a transformer at either end of the transmitting line. These inconspicuous devices perching boxlike so humbly on poles or squatting massively in iron shacks under the steel towers are the real heart of modern electricity. If it weren't for transformers electric power would have to be used a few miles from the power house. Every farm and hamlet would have to make its own juice or go without it. So Steinmetz, working happily on the coils, the iron cores, and the cooling systems of these vital machines, felt that now he was really in the vanguard. If he didn't step fast the industry would be treading on his heels.

Alternating current didn't gain its victory without a struggle. No new method does. There were powerful interests already using direct current which didn't want to see this cheaper and better kind of current put them out of business. They appealed to the public, that last resort of economic lost causes, and had laws

written into the books forbidding the use of high-tension lines in settled districts. They had the sensation-hunting newspapers print scareheads blaming every electrical disaster on the alternating current. They pointed out that the current was of such fundamental deadliness that it was used in the electric chair. In our larger cities there are still areas of direct current standing as monuments to this period of more than usual public stupidity.

The General Electric Company was instrumental in overcoming this obstacle. It was one of the reasons for its formation. Gradually the public and the newspapers came to observe that alternating current if properly handled is no more dangerous than any other kind. The public observed that it was vastly cheaper and more convenient. The cost of current began falling and has been falling ever since. The public soon changes its mind when a pleasant bit of corporation-baiting boils down to an actual matter of dollars and cents.

The alternating current brought with it a host of new difficulties. Direct current is as simple as water flowing through a pipe. If you make the pipe larger or increase the pressure you get more water flow. If you make the pipe small the flow dwindles down to nothing. It's all delightfully simple and easy to calculate. It works according to Ohm's Law, E=IR, the

most tractable and domestic natural law ever discovered.

But alternating current is different. It has neither a constant value nor a constant direction. The kind usually employed on the power lines reverses itself 120 times a second. It not only reverses itself but increases and decreases at a rate depending on no end of complicated factors. One hundred and twenty times a second there is no current flowing at all.

This was the dragon which Steinmetz undertook to tame. Engineers as yet were almost completely in the dark about how to calculate its values under practical conditions. As with hysteresis before Steinmetz took it in hand, they had to use the old faithful cut-and-try. Many an expensive model went to the junk heap because the current didn't behave as expected.

The General Electric didn't have much work for Steinmetz to do in 1893. The company was in the midst of one of those disastrous financial panics so common at the time. No one had any money for electric apparatus so the General Electric had no orders. There was little for the draughtsmen to do. Most of them were laid off. Steinmetz was kept along as too valuable to lose. He spent his time smoking long thin cigars over some abstract work of his own

or sitting cross-legged on a table talking mathematics with a colleague.

He fooled around a bit with the induction motor, an alternating-current machine just invented. He added some finishing touches to his Law of Hysteresis. He came more and more to the conclusion that the future of electricity lay with the alternating current and that he had better get busy and find out how to deal with this maddening and baffling force. His notepaper began to be covered with strange signs and equations no one had ever seen before.

A Bird's-eye View of His New Country

ABOUT the only interesting thing Steinmetz did while at Lynn was to go to Chicago. The World's Fair was in full swing and the General Electric had an elaborate exhibit. Steinmetz went along with several other engineers to see that no dramatic troubles developed in the machines on exhibition. Electricity was on trial. The public was well disposed and interested but it had very small confidence in this new force so hard to understand and so different from anything it had seen before.

The World's Fair was quite an experience to Steinmetz, who had a tendency to keep his nose close to his books unless pried forcibly away from them. In

the first place he had no idea that the country was so large. Figures representing mileage mean very little. You have to cross a country on a slow train before you get an impression of how big it is. The only land travelling Steinmetz had done up to this time was from Zürich to Cherbourg and from Yonkers to Lynn. The trip to Chicago is a long jump in comparison.

The fair itself was a vast hive of thrilling activity. It was lit with electric lights, something new to most people. And the first electric elevated railway in the country ran snakily around the grounds. Steinmetz was delighted to find in actual operation so many electrical devices which until then he had seen only on paper. He puttered around, following every pair of wires to see what new wonder was at the end of it. He was as tickled as a boy with a new toy. The whole world was a toy to Steinmetz. He played with it all his life.

Every now and then he'd run across an engineer friend who'd show him the exhibit of his own company. Steinmetz would listen with attention, admire the machines, and then take his friend firmly by the arm. He'd lead him proudly to the brilliant booth where a circle of lights surrounded the magic letters "G. E." He'd demonstrate the apparatus part by part, showing as much enthusiasm over the smallest

detail as over the broadest innovation. It didn't take much to arouse loyalty in Steinmetz. Those few months in Lynn had given him a loyalty to the General Electric which never afterward faltered for a moment.

When he got back to Lynn he learned that the whole engineering staff was going to pack up and move to Schenectady.

PART FOUR

THE ELECTRIC CITY

THE ELECTRIC CITY

Look Alive, You Dutchmen!

SCHENECTADY then was a peaceful little city on the Mohawk, slumbering deeply beside its muddy river. Union College slept profoundly on a green hill. Long-winded lawsuits droned along in the courthouse. Farmers' wagons creaked into town on Saturday to creak back again with the week's provisions and supplies. Canal barges crept at two miles an hour up and down the Erie Canal, the mules resting every mile or so. There was a strong Dutch tradition in the town. The Vans were still a solid phalanx in the better district. Society was a closed circle. Everybody went to the Dutch Reformed Church. Even the paving stones were larger and flatter than in most cities.

Now all that's changed. Schenectady is the Electric City. Fast trains fly back and forth like weavers' shuttles on the main line to the West. If you approach the town on one of these your first impression is of tall power lines striding across the countryside two hundred yards at a step. If it's nighttime, you see a

tremendous searchlight sweeping across the sky with a slow and powerful rhythm. Orange lights glare from a window of the laboratory building and are seen for miles.

On the main street the General Electric broadcasting station, WGY, bellows at you from every second doorway. Never mind what it's trying to say. It's the voice of General Electric making you welcome. It can outshout the loudest traffic.

The General Electric is Schenectady. Ice cream is delivered by the General Ice-cream Company. All the carlines in the city converge fanwise in front of the company's principal gate.

To the small and lethargic Schenectady of 1893 came the mighty G. E., attracted less perhaps by the city's excellent transportation facilities than by the prospect of having a place all to itself where it wouldn't be bothered by obstreperous labour unions or unsympathetic city aldermen. With it came a burst of action such as the town had never seen since Van Curler, the Dutch founder, was drowned in Lake Ontario. Energetic workmen cleared a flat place near the river and ran up factories and offices with bewildering speed. Energetic business men remade the city's supply and produce system. Energetic young engineers speaking a dozen accents hiked in groups up and down along the slow-paced streets. Among

them was Steinmetz, hitching jerkily as if one leg were a crutch. For the first year or two the village children laughed at his queer appearance. Soon they got used to him. Finally they took to pointing him out to strangers as the home town's ranking miracle.

Gentlemen, I Hope You Have Been Interested

BY THE time he moved to Schenectady, Steinmetz at last had developed his long-sought method of calculating the alternating current. It used a mathematical expression called a "general number," and Steinmetz preferred to name it "the symbolic method." It was complex and exceedingly long. It dealt with every conceivable condition and solved once and for all many of the most pressing problems then perplexing electrical engineers. But for four years the profession as a whole was unable to take advantage of this powerful new tool. There was a reason for this.

If you go to a technical library and notice three red volumes which weigh more heavily on the shelf than their neighbours they are apt to be *Steinmetz on Alternating Current*. He wrote it in three parts—Theory, Theory and Practice, and Practice. When it was done he took it to the International Electrical Congress. The directors were somewhat amazed

when the curious little man with the earnest expression held up for their examination almost a cubic foot of closely written manuscript. But nevertheless they assigned him a room and an hour in which to read his paper.

When the time came Steinmetz was ready on the platform, dressed in his usual funny clothes, shirt open at the collar. He was fidgeting nervously, eager to get at the pile of manuscript on the desk in front of him. He began to read. The audience began to look baffled. So technical and abstract was the discourse that one by one the hearers drifted away, each man with an individual headache. At the end of half an hour hardly a handful were still in the room. Steinmetz looked up with a pained expression. He couldn't understand it. He hadn't learned, he never did learn, that no man is willing to listen to a lecture so far above his head that he's ashamed to admit how little he understands it.

Things were at rather a crisis. It would be a shame to read the paper to an empty room. But just then the door opened and a crowd of men who had been listening to a more popular lecturer flocked in. There was nowhere else to go and they hadn't yet had a sample of what Steinmetz could hand out. He returned to his manuscript with a happy smile, secure in

the knowledge that these new listeners wouldn't all leave before his time was up.

At the end of the assigned hour he had hardly made a dent in the tremendous manuscript. He asked for a ten-minute extension. It was granted. When this was exhausted he asked for another. It was also granted. Finally he packed up his papers and smiled happily at his uneasy audience.

"Gentlemen," he said, "I hope you have been interested. I am almost half through with the introduction."

Such a work is expensive to publish, especially when it is made up almost entirely of mathematical symbols. The International Electrical Congress didn't have the money, so the symbolic method lay forgotten in its files until the author dug it out and persuaded McGraw Hill Company to print it. Now it is one of the classics of electricity.

In the four years between the reading of the symbolic method and its publication Steinmetz went placidly on using it in his daily work in spite of the fact that no one knew what he was talking about. Except for a few General Electric engineers to whom Steinmetz had explained the method personally no one had the slightest idea what the new symbols and equations meant. When he read another paper on the same subject before the American Institute

of Electrical Engineers the audience gave it up and left the room. But Steinmetz didn't mind. By this time he was quite used to not being understood.

Easy-going Miracles

EVEN if the symbolic method wasn't widely understood it established Steinmetz in Schenectady as one of the local miracles. There were quite a number of them at the time. The General Electric Company from its foundation was a remarkably efficient mutual-admiration association. There might be jealousies and rivalries but on the whole each man got a great deal of praise from his associates. This is fine for a company. If every member thinks both he and the others are pretty wonderful such is likely to become the case. In science as well as in politics or music a little worship is just the thing to establish the requisite degree of self-confidence.

In the 'nineties the General Electric wasn't the awe-inspiring colossus it is now. It probably had the same relative position in the industry but electricity itself didn't loom as large on the industrial horizon. Electric lights were still an admired luxury and the matter-of-course electrification of everyday life was a thing of the misty future. So when, in 1894, Steinmetz was made head of the calculating department it

wasn't a great executive position. If it had been, Steinmetz wouldn't have been appointed to it. He was easy-going to the point of sloppiness. He was all too apt to take the work of others on his own shoulders instead, as the good executive should, of spending nine tenths of his time in finding subordinates to do it for him. Half the time he himself didn't know how he did his work. Often he would merely read the problem through and allow a mathematical miracle to take place automatically inside his head. This was confusing to his assistants. In spite of this Steinmetz, when he chose to put his mind on it, was a marvellous teacher. He could put a problem on the board and make it seem as simple as arithmetic although it might involve the most advanced mathematics. As soon as he stopped talking, to be sure, a certain murkiness developed, and the engineer pupils wished they had taken more complete notes. But Steinmetz didn't mind repeating the thing over and over again until his hearers finally saw the point. He had the two essential characteristics of a good teacher—patience and the ability to inspire confidence. With these qualities a man is a real teacher.

When first appointed, Steinmetz was ideal for the place at the head of the calculating department. There were few men under him. They were all his friends and he could personally see what they were

doing and look up from his own work to give them a helping push over each obstacle. But as the company expanded and assistants became more numerous he fell down entirely. Routine work developed and this sort of thing Steinmetz never did understand. He could do any number of routine problems without being troubled at all, but when it came to seeing that his assistants did them he was as helpless as a babe.

A manufacturing executive would rush into his office with a difficulty about a new motor. Steinmetz would look over the problem, judge it very simple, and promise to give it the necessary fifteen minutes when the time came. Often as not that time never came. A real executive would never have thought of doing it himself but would have turned it over to one of his carefully trained assistants. But Steinmetz's assistants were as free as the air from any direction from him. He hated direction himself and never needed it. Consequently he never could see why others should need it. The problem would lie untouched until the wheels of the factory ran slow and the general manager came storming up to the office to see what on earth was the matter. Steinmetz would smile disarmingly, turn to the problem with mild annoyance, solve it in a few minutes, and wonder

what all the shouting was about. He was never cut out for a captain of industry.

The Scientific Supreme Court

FOR several years the company officials watched the calculating department go brilliantly from bad to worse. They watched the process with admiration not common to executives who detect a friction point in their smooth-running machine. Problems were solved in Steinmetz's grubby office which had all the engineers in the country stumped. But a great many other problems were not solved which were really work for amateurs. Often these problems touched the very life of the growing factories. Something had to be done and that at once.

The dilemma of the officials was a perplexing one. Steinmetz was above all considerations their most valuable man. He was exceedingly sensitive and temperamental. They couldn't afford to offend him for he was the only living man who completely understood that symbolic method which gave them their most decisive advantage over their competitors.

One day two of the highest officials came into Steinmetz's office to find an active argument in progress among his assistants. Steinmetz was working away at his desk, quite unconscious as usual of what

was going on around him. The officials listened to the argument for a few minutes. It involved very complicated calculations and was making no progress toward solution. Finally one of the assistants gave it up in despair.

"There's no use," he said. "Let's ask the Supreme Court."

Steinmetz was still unconscious. They touched him on the shoulder and he looked up with his usual whimsical smile.

"Say, if you bore a hole two inches in diameter through a rod also two inches in diameter, how much material is removed?"

Steinmetz put down his pencil and stared into space for a moment. Then he took a sheet of paper and wrote out the answer.

"5.33 cubic inches," he read.

It was entirely correct. The engineers later verified it with tables of diagrams and other aids to ordinary mortal intelligence. Steinmetz had done it without effort, exactly as we multiply five and five. The delicate apparatus of his brain was so smooth-running as to be almost automatic.

The two officials went out of the office in a state of amazement. This then is the man we've got working for us. And we were about to demote him for gross inefficiency!

"But he is inefficient," said one. "The calculating department is a mess. Nothing ever gets done but problems hard enough to interest Steinmetz. He'll wreck the place yet."

"I've got an idea," said the other suddenly. "You remember what that assistant of his said: 'Ask the Supreme Court.' That's what Steinmetz ought to be, a scientific Supreme Court. Let him putter away at anything he wants to. The only thing he wants to do is work. When a problem comes up which has got everybody else buffaloed we'll call him in. He'll let that brain of his buzz for a minute and the problem will be solved. Nothing simpler."

So they made Steinmetz consulting engineer, with a salary all-sufficient for his simple needs and an unlimited expense account for apparatus and assistance. Probably he never realized clearly that the routine work of the factory had been taken out of his hands.

Private Life of a Myth

A BIOGRAPHY of a modern great man should be divided into two distinct sections. The first should deal with his early life and early struggles and should attempt to evaluate the psychological and other reasons for his subsequent greatness. The second

should deal with his life after the newspapers have raised him to the level of a living myth.

Only in modern times have we been able to see mythological characters in the actual flesh. Perseus and Jason died long before any reporter had a chance to interview them. Washington wasn't a myth until a good many years after the death of the last person who knew him well. But now with the unification and extension of the instruments of publicity a man's real character may die at the age of thirty-five and a strange, unnatural, misty thing walk about in its place. This thing is spun of the suppressed desires of ten million tabloid readers. Its flesh and blood are the business interests of a huge corporation or vaudeville syndicate. Sometimes a whole industry uses one personality as a symbol. Henry Ford is the symbol of the cheap automobile. Lindbergh the symbol of the dependable airplane.

The private characters of some men die when they are worked over into demigods. But some go on living while a double shows its painted face to the public. Steinmetz was hardly conscious of what was going on. His private life was so retired and simple that the events in the publicity world affected him hardly at all. He went on playing with his strange hobbies and reading his dime detective stories. To his intimates he changed very little. But he developed

a method of dealing with the public. Another Steinmetz interviewed reporters, sat on the school board of Schenectady, and said silly things to the magazines about science and religion.

From now on this book will try to describe Steinmetz as he really was and not as the newspapers would make him appear. But it would be a criminal omission not to sketch in lightly the figure of the publicity Steinmetz sitting beside the real one as he read his detective stories, or standing beside him as he worked in his laboratory. Especially since this figure grew less misty as Steinmetz grew older and his scientific energy flagged. Finally there came a day when the real man was almost merged in the false one. When Steinmetz almost believed the stories told about him.

Fame

IN THE last fifty years or so the power of Almighty Publicity has grown amazingly. There may have been brave men before and after Agamemnon but it is pretty certain that their reputations didn't grow with anything like the rapidity of Tunney's, say, or Lindbergh's. Nor were reputations of fifty years ago nearly as widespread. Even the names of military leaders and statesmen penetrated slowly into the

public consciousness. The European peasant seldom heard of a general before he woke up one morning to find the troopers of that general raiding his chicken coops. The American farmer seldom knew who was running for office until a political organizer came to his isolated community to tell him about it. And the generals and statesmen are public officials whose acts may affect the well-being of every household.

How did people of less immediate importance to the masses fare in those days? How did scientists, writers, actors, and athletes get their names before the public? Briefly, they didn't. They were known to a comparatively small circle of admirers. Those people who were interested in their specialties took pains to search them out. The cities they lived in knew about them and were proud of their greatness. Once in a great while some Jenny Lind would flare like a comet across the public mind but these visitations were few and far between. There was no Clara Bow to set the mind of every schoolboy running along the lines of "It." There were no Channel swimmers to write their names deep on the sands of popularity, only to have them erased in a week or two to make room for the next sensation.

The reason for the amazing increase in the power of publicity is not hard to find. It is due to the modern improvements in communication. They have been

many and various and have profoundly changed the habits of the nation. Never before did one hundred and ten million people think with such a single mind.

Probably the newspapers are the most important among these new tools of publicity. They have existed for many years but only recently have they interested the lower strata of the population. The working man could read but most of the time he didn't. There were few papers printed which fitted his interests or his order of intelligence. Sufficient proof of this may be found by adding the circulations of all the daily papers of a given city fifty years ago and subtracting the result from the total population. The part reached by all the papers together was exceedingly small.

But now everyone reads at least one paper. Most read two or even three. Often there are more papers printed in a city than there are people to read them. The same is true to a lesser degree in the country districts. Most farmers get at least one paper by rural free delivery. To accomplish this expansion in their market the newspapers had to make various changes in the material they printed. Gradually they included more "human-interest stuff," more personal items, more scandal and gossip. This is what sells the paper. Long-winded reports of the debates in Congress may dress up the sheet and give squeamish people an ex-

cuse to buy it. But what these people read first is very different.

The vastly more numerous cheap newspapers are only one new medium of publicity. Another is the movies, which didn't take long to discover their power over the public taste and the public state of mind. Another is the radio, by means of which a candidate for office can reach the attention of twenty million listeners before his words are heard in the back of the hall. The magazines, weekly and monthly, have also multiplied amazingly and add their intermittent shouts to the steady pounding of the newspapers. No wonder the mind of the American public has become so sensitive to suggestion that it vibrates like a piano wire when the tuning fork of publicity is sounded softly across the continent.

The modern development of publicity is one of the typical American processes of standardization and mass production. The country has become so bound together by subtle and powerful bonds that it vibrates as a whole to a single stimulus. And just as products like cigarettes or radio sets have been standardized to meet the tremendous market provided by national advertising so have famous men been standardized to interest the great mass of newspaper readers whose minds are not complex enough to comprehend a complete human character.

Standardization is essentially simplification. The individualistic product intended to meet the special needs of a small group has disappeared to make room for the standardized product which fills moderately well most of the wants of the hundred million. Ford cars are not made with custom-built bodies. Lucky Strike offers only one type of cigarette.

The same process can be seen in the world of publicity where men are sold to the public on the slave block of the copy desk. A human character with all its shades of subtle feeling is too complicated to fit the mass methods of the modern publicity hook-up. Before a man's character can be fed into the machine for distribution to the country it must be shorn of its ever present contradictions, dressed down to a few picturesque features, and presented as a standardized symbol, easy to understand and easy to remember. This is what happened to Steinmetz.

The peculiar personality of Steinmetz lent itself very conveniently to the process of national popularization. He was unconventional in many ways but his unconventionality was of such an innocent, even childish, quality that it never offended the most easily blushing sensibility. His unusual dress and his remarkable habits were merely those which all children and many men would adopt at once if they thought they could get away with it. His appearance was an-

other advantage. It was so striking that it would stand out on any picture page. The dumbest reader would stop to look even if not to admire.

So with typewriter and linotype the newspapers set out to make Steinmetz into a popular human-interest feature. They picked out half a dozen pictures of him and stuck to them through thick and thin. Over and over again they printed the same stories about his personal habits. His cigars became matters of national knowledge. Every newspaper reader knew that he didn't take much care of his clothes. The words "wizard" and "magician" were scattered thickly through the text. And the yarns about his stupendous salary grew and grew until in the mind of the public he became one of the most highly paid men in all America.

Needless to say most of this stuff was misleading and much of it was actually untrue. But that isn't the point. Steinmetz was becoming a national figure and such people have to get used to being distorted in the newspapers. The Sunday magazine section of a low-grade paper can't go into subtle analyses of character. Its readers don't want to learn about the complexities of a great man. They want a lay figure with no intricate plumbing inside. They want a straight-line symbol which demands for complete

comprehension only a minute or two of their restless attention.

Excusable Vanity

THE popular reputations of scientific men are usually of two general types, both readily understandable to the public. There is the inventor, the producer of new comforts, the benefactor of the human race. Of this type Edison and Marconi are good examples. Then there is the "wizard," the juggler with matters far beyond the comprehension of the ordinary man. The public reads about these, doesn't even attempt to understand what they are doing, and delights in speaking of them as somehow supermortal. Einstein is the leader of this type; Steinmetz in his day was a close second.

These types are often confused. The reporters, most of whom have the haziest ideas about science, become so used to dressing their lay figures in one or the other of these sets of clothes that sometimes they get the garments mixed. Edison appears as a wizard, although his methods have always been the purely mechanical ones of trial and error. Steinmetz blossoms out as an inventor, although his inventions were vastly less important than his more theoretical work.

When at its height Steinmetz's reputation was somewhat mixed. The public considered him an in-

ventor. The word is a convenient handle. But he hadn't invented anything important which the public had heard about and he never did. Some people could tell you that he was an electrician but few knew what part of electricity was his province. Engineers could tell you but they don't constitute the public.

For the most part Steinmetz, like Einstein, stood for something mysterious and amazing—the kind of science little removed from magic and religion. It was common then to say that there was something nonhuman about his brain, something which the generality of mortals had better not try to understand. This impression was stimulated by the newspapers, which are always grateful for a stock miracle with which to fill an uncomfortable lack in the feature section. It was fostered industriously by the publicity men of General Electric, for certainly there's nothing better for business than to have each bit of finished product signed by a demigod.

So Steinmetz's reputation grew beyond all bounds. It finally outgrew the actual man to such an extent that it lost even a family resemblance to him. Such publicity-built characters are not human. They have printers' ink in their veins instead of blood.

Some men could have stood this blast of fame without changing. Some men have the faculty of self-evaluation. Steinmetz did not. He vacillated between

timidity and extreme self-appreciation. In the course of time his natural character succumbed and the made-to-order character took charge. More and more the modest little Steinmetz of Breslau and Yonkers came to resemble the wizard of the magazine section.

We mustn't blame him for reflecting in vanity the praise which flooded in on him with every mail. Nine men out of ten would have done the same and the tenth would be a person accustomed to praise from boyhood. Vanity is a plant which germinates in the dark and bursts into rank growth as soon as the faintest ray of sunlight reaches it. We ought to forgive the vanity of those abnormal men whose structure of self-respect is built on a single supporting pillar. If a man is an all-round success, if he plays a good game of golf, if his professional reputation is above the average, if his secretary thinks he's good-looking, if there are dozens of small points on which he can preen himself—then no one will notice his vanity. But when all the eggs are in one basket, when all hopes, comfort, and respect depend on one outstanding ability—then a man's associates begin to say that he's vain. They notice with annoyance the little heap of vanity which if spread over a broad surface would attract no attention. But he can't help it. He has to be vain on this one point. If he were not he couldn't hold his

head up in self-respect. He can't fall back like other men on his athletic ability, his prowess with women, or his appearance in lodge regalia. He has to be vain or he won't be anything at all.

The Wizard at Work

IF YOU could catch the mythical "average man" of the early 1920's and ask him what Steinmetz was like he would paint you a word picture of a wizard in his laboratory. Tremendous machines would be standing about. Powerful forces would be bottled in frail glass containers, ready to leap destructively at a hint from the master. There'd be a subdued throb and hum in the atmosphere as if the place were the den of some fearful scientific dragon held in leash by the superhuman intelligence of the little man who knew all the secrets of the universe.

But actually the situation was very different. Steinmetz was never a very effective laboratory manipulator. Dozens of men in the General Electric research department were more skilful with galvanometer and test tube. Steinmetz was actually scared to death of a live wire. He had an encounter with one early in his career with the General Electric and as long as he lived he never got over this healthy fear. Other men might show lion-tamer familiarity with

the many sudden deaths of the laboratory but not Steinmetz. His precious brain was too thinly clothed with flesh to allow him to take any chances.

The "average man" is right about the general appearance of an electrical laboratory. There is a feeling of danger, subdued power, and deadly energy about the place. Aristocratic wires stand aloof on tall insulators as if to warn the careless that death is present in every inch of their slim length. Motors hum softly, revolving so fast that they don't seem to revolve at all. And in the mazes of smaller wire, in the clusters of vacuum tubes, in the groups of intricate measuring instruments, the more imaginative can feel the presence of a power none the less terrible because of its subtlety.

Steinmetz's laboratory presented no such appearance. The machines were all there but most of the time they weren't running. The only live wires were the familiar insulated ones containing the house current. When he was doing some experiment which demanded high voltage Steinmetz didn't hesitate to bring this dangerous monster into his sanctum, but when the experiment was finished he got it out again as soon as he could.

The most high-powered machine in Steinmetz's laboratory was Steinmetz's brain. It dominated the place as an airship dominates a landscape. It was a

wonderful sight to see Steinmetz working with pencil and paper. A turbo-electric generator gave no such impression of power.

Some laboratories dominate the man. Not so Steinmetz's. One day in the middle of winter a friend came to visit him. There was no fire in the stove and the zero weather was making itself felt unpleasantly. Steinmetz was bundled up in many coats, working away at his desk with stiffened fingers.

"What's the matter?" asked the friend. "If you're taking a fresh-air cure you'd better leave the windows open."

Steinmetz looked up from his work a trifle sheepishly. He pointed over his shoulder to the stove, which was filled with a litter of paper from the wastebasket.

"A mouse has just had some children in there," he said. "I can't take them out until they grow up a little."

Matter of Dollars and Cents

PERHAPS the silliest things which appeared about Steinmetz in the newspapers were the reports of his salary. The salaries of well-known wage earners are very frequently the subjects of confusion chiefly because there are seldom any definite data available about them. A corporation doesn't like to give out

reports about such intimate matters. If the salary is admitted to be high there will be kicks from the stockholders and howls from the other big men in the organization who aren't getting as much. If it is small the company will be accused in the newspapers of everything from injustice to actual fraud.

So for years wild rumours about Steinmetz's earnings went the rounds of the press. These were absurd and contradictory but apparently newspaper editors think in a remarkable manner which does not prevent them from printing one thing one week and an entirely different thing as soon as the first gets cold.

These rumours were of three general types. None was entirely true.

The simplest story said flatly that he was making upward of $100,000 a year. Some went as high as $200,000. This, of course, is absurd. Steinmetz never became a very wealthy man and if he had received this salary and continued to spend as little as he did he would have been a millionaire at the time of his death. No amount of poor business judgment could have used up such a tremendous income.

Another school of thought maintained that the General Electric kept bothering him with offers of money which he consistently refused. One little item, syndicated in a thousand papers, said that he refused one offer of 30,000 additional dollars a year but ar-

ranged for it to be divided between his various assistants. This doesn't sound like the General Electric or like Steinmetz either. The G. E. is no charity organization concerned with social justice. Like every company which has to answer to a body of stockholders, it tries to get as much as it can for as little as possible. If it hadn't done this for many years it wouldn't be the power it is now. And certainly Steinmetz would have accepted all such offers, Socialism or no Socialism. Perhaps he wouldn't have spent much of it on himself. His personal requirements seemed to be fixed permanently at a very low figure but he would have enjoyed immensely using the sum for his peculiar charities. Much as he admired the General Electric, he wasn't convinced that it was worrying much about the greatest good for the greatest number.

But the most picturesque theory, and therefore the one most popular with the newspapers, was that he received no salary at all but enjoyed the privilege of drawing checks on the General Electric's treasury for any amount he chose. "From a pair of shoe laces to a million-dollar laboratory," as one reporter puts it. Probably no editor printed this with a completely straight face. But print it they did, in large type and small, in long articles, and in little boxes set into the front page.

Of course such reports were completely unfounded. Any company which allowed such latitude to one of its employees would be the subject of immediate action from the stockholders if not from the state. The General Electric had too little confidence in Steinmetz's business judgment to let him have any sort of authority over its finances, and drawing checks freely on the treasury of a company is almost like controlling its financial policy.

The facts of the case are hard to get at for the reasons mentioned above. Salaries are sensitive matters with both employers and employees. But in all probability Steinmetz received a large but not stupendous salary. He hadn't the bargaining capacity needed to extract raises from even the most generous employer. He was completely contented with his position at Schenectady and the company knew it as well as he did. It's almost impossible to get a raise unless the company feels in the background the possibility of losing its employee if it doesn't give him more money.

The myth about the checks probably originated from the company's generosity toward Steinmetz in giving him all the apparatus he needed. It is similarly generous toward its other scientists, for experience has shown that this policy produces the best results. But as for "million-dollar laboratories" and un-

solicited grants of $30,000 a year, we can charge these simply to the newspapers' love of sensation. Steinmetz presented the familiar figure of the man who accepts much less than he is worth because he likes his work too much to make the necessary threat of resigning.

Inventors, Scientists, and Others

STEINMETZ'S new and unusual position with the General Electric gave him more leisure, or rather more of what he called leisure. What he meant was only to be allowed to work in his own way at things of his own choosing. The position of consulting engineer gave him almost unlimited leeway. Gradually he moved more and more of his apparatus up to the house where he and another engineer had set up a rather sketchy bachelor establishment. Sometimes he'd work for twelve hours at a stretch, taking time out for an infinitesimal lunch when the clock told him that his efficiency would be lessened if he didn't.

Out of this laboratory came wonderful things. It was the most productive part of his life and the world would be much poorer if the General Electric had not had the foresight to free its captive gnome from commonplace routine and let him push his buzz-saw brain into the hazy menacing problems of the future.

This is the opportune moment to tell the reader what Steinmetz did to deserve his renown. If Steinmetz had been an ordinary scientist or inventor nothing would be easier than to enumerate the most popular achievements of his career and exaggerate a bit their importance to the daily life of the average American. But Steinmetz wasn't a conventional scientist and wasn't an inventor at all. He was completely out of touch with the economic needs which force into being most great inventions. His important work was done on paper and tried out later with actual apparatus.

It would be wrong to say that he synthesized new devices by theoretical methods. Such attempts are almost always disastrous. Machines developed on paper are often lovely to look at while still on paper but they have a disturbing way of being born dead. Some minute essential has been overlooked.

Steinmetz's real value to science and industry was as an intellectual tool maker. Some advances have been made by simple ingenuity but these are few and undependable. The general process is to have an abstract mind work out a broad principle. Then the more practical inventors can develop their machines within its limits. Recently the world has found itself in possession of more tools than it can use. Back in the Eighteenth Century, Newton, with the aid of

the legendary apple, thought out the Law of Gravitation, which gave men an entirely new conception of time and space. Newton and Leibnitz, working simultaneously, produced the calculus, a wonderfully useful mathematical tool which can be brought to bear on nearly every electrical and engineering problem. Einstein has provided enough new conceptions to keep the practical men busy for half a century. Not yet have his general laws been brought down to the level of ordinary human understanding.

Steinmetz was in the class of Newton, Leibnitz, Einstein, and the other theorists whose abstract reasonings made it possible for men with less penetrating minds to design practical machines. His greatest achievement was the method of dealing with alternating current. Before men could put this force to work they had to understand its habits and its possibilities. They had to have a mathematical tool firmly in their heads before they could predict with any accuracy what their devices would do under practical conditions. The methods which Steinmetz developed were so complete and painstaking, so craftily considerate of every possible phase, that a designer who understood them could hardly make a mistake. He had only to combine with intelligence the various rules worked out by Steinmetz and he'd find ready

made in his head a recipe for, say, a turbine generator.

The devices and methods which Steinmetz developed are largely concerned with those parts of electricity which are hidden from the public eye. This makes them hard to popularize. Everyone has seen an incandescent lamp and a vacuum tube. The inventors of these articles get immense credit. But few have seen the great transformers sitting powerfully quiet in their little houses outside the generating stations. Few have wondered why the high-tension lines strung on tall steel towers are seldom damaged by lightning. And practically none but an engineer realizes that without Steinmetz's work electricity would be about half as useful as it is.

It's hard to place the laurel for inventions on the proper foreheads. This is because the word itself is so broad and poorly defined. Strictly speaking, there are few really original inventions. Usually a long line of impractical men have been vaguely fooling around with an idea for years and have accumulated a great store of information about it without actually producing anything which meets a popular need. Then some commercial genius with ingenuity and a flair for publicity comes along, adds a few details which fit the device to some definite purpose, and reaps all the credit as inventor.

The best example of this process is Marconi, who is popularly credited with having invented radio. He would probably be the first to deny this but that doesn't change anything. Once the newspapers have soldered a convenient handle to a man it's impossible to get it off. The Hertzian waves had been known for some time and speculation was common about their future use in communication. Marconi collected various patents, organized a company, named the message from ship to shore "Marconigram," and found himself the inventor of a device whose principles had been known long before he came on the scene. Edison is another example of the clever adapter. He is popularly supposed to have invented the phonograph and the motion picture. All he did was to perfect them so that they could be used commercially. The principles had been known for years.

It would be silly and unjust to try to take away credit from men like Edison and Marconi. They are very important in the great process of discovering a principle, working it into a useful device, and getting that device before the public where it will make life pleasanter and easier to live. But they should be given credit as inspired and far-sighted business men —not as scientists. The scientists are grubby fellows hiding away in laboratories, shunning reporters, and

finding in their work the reward for a life of effort. All they get credit for is eccentricity.

Steinmetz was one of this latter class. There is no well-known invention to which his name can be attached. He had a hand in the perfecting of many devices originated by other men. And almost all electrical designers have used his mathematical methods for working out their own schemes. He must be given credit for every machine activated even indirectly by the alternating current.

It was Steinmetz's misfortune that these essential first steps in the process of scientific invention have little hold on the popular imagination. It was his good fortune that he early attached himself to the General Electric Company, for this organization not only gives its scientists every possible facility they need for their work but sees to it that when they do accomplish something their efforts shall be repaid with a just amount of fame.

Prenatal Care for Inventions

STEINMETZ would never have been heard of in the talking places of the world if it hadn't been for the remarkable institution which the General Electric was developing at Schenectady. This outfit is privately operated but should be considered a national asset.

The nation's place in science and industry depends on just such institutions as the General Electric research laboratories.

These laboratories are not run as a charity or to further the cause of science. They have as a firm foundation the cold commercial fact that the G. E. is so large and manufactures such a diversity of products that every discovery, electrical, chemical, or physical, is bound to become useful sometime. If the factories aren't making an article which uses a great discovery they can do so presently.

So the G. E. keeps a herd of scientists up there in the pleasant little city of Schenectady. Pays them good salaries; gives them houses to live in and well-equipped laboratories to work in. It lets them work along their own lines, not worrying very much if they don't at once produce something useful. For the G. E. knows that the ways of the scientist may be peculiar but he hasn't any very strong desire except to work.

These lucky scientists work happily, free from the poverty of college professors, free from the business worries of independent inventors. Their ideas, of course, belong to the company. There's a rigid contract to that effect. But there are numerous rewards, financial and otherwise, for outstanding success. And when they do accomplish something unusual

the publicity department tells the world about it in no faltering whispers.

The Quiet Pool of Success

THE life of a man of action is one of constant chronological interest. He is always doing something definite, and if these things are important they are apt to be interesting to read about. But this isn't so with a scientist. His early struggles and formative years may be filled with action and tribulation but it's from no choice of his. Action to a real scientist is merely the necessary annoyance incidental to his bread and butter. His real work is done in the silent hours of thought, the apparently aimless days of puttering around in the laboratory, and the mighty searching through libraries of reference books.

In dealing with the life of Steinmetz the chronological method falls down completely. As soon as he was firmly established with the General Electric and was happy in the possession of a great reputation, his life slowed down and broadened out. It was like a rapid, troubled river which suddenly finds itself past the last pile of rocks and quietly flowing into a smooth pond. There were no more petty bothers such as routine work to be handed in on time. He could

breathe easily at last and look about him for some of the pleasant things he had missed.

All the time his mind was working as hard as ever. It couldn't stop. But there's a difference between work which runs on by itself and work which is pushed from behind. Every really able man hates his boss, no matter how just and kind that boss may be. The mental figure of the boss gets between him and his pleasant leisurely thoughts. When all shadow of control faded from Steinmetz's life he began to notice new delights which he had never before hoped he could enjoy.

He had more friends now. Schenectady was full of engineers and scientists who admired him so much for his mind that they could forgive his body. People with large minds are apt to forgive the body. Physical perfection is the pride of those with no claim to perfection of any other kind.

The General Electric engineers were an interesting lot. They came from all over the world and brought with them a cosmopolitan attitude toward life and intellectual matters which was a great relief to the Breslau German adrift in a strange land. There were some who spoke his own language and there were lots that didn't speak English any better than he did. A good many had horrible manners and were as lacking in social education as he was. Such things help when

a man is afflicted with a damaging sense of social inferiority. Steinmetz for the first time had men to associate with who were not the waifs and strays of the world and who still didn't look down upon him as an unpleasant, uncultivated little cripple.

Soon he was tramping about the pleasant country of up-state New York, hitching happily along on his leg like a crutch, smiling joyfully like the small child he always remained. The other engineers teased him sometimes and a good many of them, prima donna-like, were jealous of his growing reputation, but on the whole they treated him very well. No one who got really to know Steinmetz could help loving him.

Horticulture

As Steinmetz developed under the influence of praise and flattery a measure of self-appreciation he began to indulge his strange fancies in various grotesque ways. He had a passion for unusual plants and animals. The uglier they were the better. The more thorns, prickles, fangs, and claws they had the better he liked them. If a beast or bird was an outcast, like the crow, or an enemy of mankind, like the snake, he would take it under his protection, care for it tenderly, and pet it as if it were the most engaging and helpless kitten.

Soon after his arrival at Schenectady he had a small conservatory built adjoining his house. This he gradually filled with cacti. They were not the beautifully flowering delicate things which are seen in the windows of fashionable florists, but vast ungainly columns of thorns, misshapen bulbous masses covered with needle-pointed white hairs, snaky, winding horrors with groups of unnatural fruit growing like ulcers at the tips. These were Steinmetz's friends. He spent thousands of dollars pumping steam into the conservatory to keep it at a tropical heat while the temperature outside was twenty below. He welcomed new arrivals with joy, and if they were more horrible than the average he ruthlessly threw out the old to make place for the new.

Whenever his mind was not actively engaged on some enthralling problem the twisted little man would putter around among his twisted plants. He'd water them sparingly with a long-spouted watering pot. He'd test the sharpness of their thorns with the tip of his forefinger. He was happy in their society. They represented to him the survival of the almost fatally handicapped. Their ancestors had been forced to live in an unwelcoming desert. They had adapted themselves to the conditions. They were successful. They had even achieved a certain amount of beauty of a sort, and they were safe from browsing cattle or

destroying insects. Steinmetz puttered among them happily. He had not a self-analytical mind. He probably never wondered why he liked these strange friends so much. But he had adapted himself too. He was at home in an unwelcoming world. He had no thorns but he was as twisted as they.

Nature Study

CACTI weren't Steinmetz's only diversion. He came to love the easy-going Mohawk—perhaps because rowing and paddling were not sports in which he was handicapped. Soon after his arrival he and his housemate bought a small boat to explore the quiet waterways. As a river the Mohawk isn't much except in flood time but as a canoeing ground it is ideal. The current flows gently. The channel winds about bewilderingly. Little creeks come to join the main stream and little islands covered with a felt of willows and driftwood stand away to invite picnickers. The shores are high and apt to be heavily wooded. On the plateau above are thriving farms where milk and eggs are almost given away. Steinmetz in his little boat, smoking his thin cigars, would drift about on this low-geared paradise for hours. He was placidly happy there. The suppressed vestiges of his German nature-sentimentality came to the surface. The river was a

good antidote for the fierce mental excitement of mathematical research. Rivers do not stimulate a man's sense of responsibility. They may be very firm about their own ambition to get to the sea but they keep this to themselves.

Steinmetz liked the river so much that presently he decided he'd like to own a part of it, or at least a part of its banks. This wasn't difficult to achieve. The lowlands were valuable for farming but the high bluffs were worthless except for their timber.

So in due course of time he leased a small bit of land on an almost perpendicular bluff and presently he and a company of friends descended on it to make the plans for the camp. The actual building was done by a near-by farmer who said he was more or less of a carpenter. It was a crazy thing at best. Numerous people remarked that it looked like its owner. Perched precariously on the bluff, it stuck out crookedly over the stony bed of a small creek. It consisted of one small room and an even smaller porch, which was supported by meagre two-by-fours projecting at an angle.

It is said that Steinmetz had doubts about how strong this porch was. Of course he knew all about such things as stresses and moments of force but here was a matter which affected the well-being of his

Courtesy of General Electric

A VOYAGE OF MATHEMATICAL DISCOVERY

delicate body. It wasn't exactly cowardice. Steinmetz had plenty of moral courage and resolution. But his physical caution was something trained into him by years of bitter experience. When a man has to give a major portion of his attention to preserving a frail body from total destruction he has a right to think twice before taking a risk.

So Steinmetz kept carefully to the landward side of his camp. When the work was finally finished he decided to give a party. He invited all his friends and hired an orchestra. There were plenty of refreshments. Steinmetz placed both the orchestra and the punch-bowl well out on the porch. As the party progressed he stood in the back of the room and made mental notes of the number of guests on the outside edge at one time. The porch showed no signs of collapsing. Then Steinmetz himself went over and looked out of the broad windows. The view, he decided, was very excellent.

A Best-selling Anecdote

ABOUT this time an incident occurred which gradually broadened into the most famous Steinmetz story. I tell it, not because it is necessarily true or even very interesting, but because it illustrates how skilful publicity can take a simple anecdote and expand it into a

powerful vehicle for getting a man's name before the public.

Steinmetz, as is well known, was a frantic smoker. He was never happy without a cigar between his teeth. These cigars were famously long and thin. They looked like twisted ropes. They cost extremely little. As Steinmetz became more prosperous he tried better cigars but found that his taste was so perverted by years of these atrocious stogies that elegant Havanas didn't seem right at all. These cigars were a joke as far back as Yonkers. Steinmetz often said that he couldn't think without a cigar in his mouth and he was thinking all the time.

When the General Electric moved to Schenectady the quarters provided for the laboratories were very meagre and flimsy. New buildings were going up rapidly but were still far from completion. For some time the research and calculating staffs were housed in an old wooden building divided into small rooms by board partitions. The place was a fire trap. So, prudently enough, the authorities posted large "no smoking" signs and sent inspectors to see that the order was enforced. It wouldn't do to have a million dollars' worth of apparatus and brains go up in smoke.

The story goes that Steinmetz came down to his office that morning, took one look at the sign, screwed

his cigar more firmly into his mouth, and scrambled down the stairs for the free outdoors. He went home and didn't appear for the rest of the day. Later he sent a brief note: "No smoking," it said, "no Steinmetz." A special exception to the rule was made and he came back to work the next day, his cigar burning more fiercely than ever.

This story has appeared between then and now in practically every paper in America. It has been printed in German, in Yiddish, and in Italian. People who know nothing else about Steinmetz will tell you this story in infinite detail. When the papers printed pictures of Steinmetz they took care never to have him without a cigar. It was his Order of the Garter, the symbol of his place in the admiration of the American public.

There have been various denials that this incident ever took place. What probably happened was that the order was generally ignored by most of the engineers, Steinmetz among them. It is likely that the company intended it only for the humbler white-collar workers in the building. At any rate there are still plenty of non-fireproof buildings around the General Electric works and the engineers all smoke merrily.

This story with its flimsy foundation and its universal appeal makes an interesting study in the ways

of publicity. Millions of poor little clerks living under the petty tyranny of a hated boss took Steinmetz to their hearts when they heard this story about him. The great mathematician they dismissed as just another highbrow but the man who smoked when his boss said he mustn't—there was the man for them. When they saw his picture in the paper they noticed the inevitable cigar, subconsciously put themselves in his place, and rejoiced in their own courage.

Transaction

FOR the first eight years or so of his life in Schenectady Steinmetz lived around in various rented quarters. As he came up in the world he progressed from lodgings to a good-sized house shared with a colleague. But all these places had their disadvantages. Landlords are timid folk. When they came to collect the rent and found charred places in the living-room floor or were met with nerve-shaking explosions from the cellar they were apt to make frantic protests. Steinmetz and his friends didn't seem to care much for their worries. Experiments had to be done. Some of them were dangerous. If the place burned down—well the landlord had insurance, hadn't he?

The straw which broke the landlord's back was the burning of the stable behind the Liberty Street

house. Steinmetz had a laboratory in it. He lost a great deal of cherished apparatus and so wasn't inclined to sympathize much with the landlord's sorrows. But the protest ensuing was so resolute that he realized something had to be done. He decided to build a house of his own which he might burn to the ground if the progress of science demanded it.

The General Electric, like the good fatherly company it is, had foreseen that its employees might sometimes want to build houses. So it bought from Union College a large tract on the outskirts of Schenectady and divided it into spacious building lots. Steinmetz hunted up the agent and went to look at the land.

The lot nearest the city adjoined a deep ravine called College Creek. It was by far the most desirable but was marred in the estimation of the unimaginative agent by a large gully which had washed a great deal of earth down into the creek. Steinmetz looked the lot over with an unwontedly critical eye.

"I want to be near the city," he said dubiously, "but I don't like the looks of that hole."

The agent looked down into the wash-out. It was pretty bad, he admitted, but with a few suitable plants it might be made rather picturesque.

"Don't be silly," shrilled Steinmetz. "What do I want with picturesqueness? I might fall down there.

And it will go on washing down the dirt until I have it filled up. That will cost me a lot of money."

The agent saw the point. He made a mental calculation of the cost of filling the gully and knocked four hundred dollars off the price of the lot. Steinmetz closed the deal at once. He could hardly sign the deed fast enough.

This was the only discoverable time when Steinmetz showed a trace of business acumen. And he did it more to play a joke on the agent than for any other reason. Next to the conservatory that gully became Steinmetz's dearest delight. He terraced the sides laboriously, planted them with rare irises, made little pools at the bottom, and rejoiced that his lot was not flat and uninteresting like all the rest. He used to tell the story with naïve delight. He might be cheated right and left by men, women, and children, but once he had beaten a real-estate agent at his own game.

The Life Scientific

WHEN he got his lot Steinmetz went ahead with the plans for the house. Characteristically, and appropriately too, it was the laboratory which he first considered. It was, in the owner's mind, the most important part of the establishment, and it ought to have first call on his funds and attention.

The laboratory was built exactly to Steinmetz's taste. All the sciences might work there side by side without jostling. There were numerous electrical outlets. There were gas and running water. There were spacious work tables of the sort which don't mind being drenched with acids or scorched by burning insulation. Above all, there was the feeling that here was a place where science, not comfort or appearance, was the chief object. There'd be no more fracases with the landlady about ruined carpets. No more complaints from the neighbours about unaccountably horrible smells.

The living quarters in this building were sufficient. That was the most you could say about them. When Steinmetz relaxed he slept, and that was all there was to it. His waking hours were taken up actively doing something. He didn't require a well-furnished library to loaf in. His books were piled here and there on chairs and tables. It was a terrible mess but he seemed to know where everything was. If he lacked an essential volume he'd 'phone to the G. E. to rush up a copy from its excellent collection.

The master of this scientist's paradise slept upstairs in one of two small rooms. He slept in a bed specially designed to fit his misshapen body. The cooking was done in the laboratory, usually on a gas burner which was part of the scientific equipment.

The dishes were washed along with test tubes and beakers. It might as well be said that the class of food which Steinmetz provided for his guests was not high. The process which produced it was too much like a scientific experiment. In fact Steinmetz, having a pretty low opinion of food as anything but a fuel for the bodily machine, was all too apt to look on it as a mere chemical compound. He amused himself seeing how many things could be cooked so as to come out yellow. With a straight face he'd propound theories for measuring the value of foods by their colour. Scrambled eggs ranked high and sometimes supplanted steak and potatoes—the standard with all bachelors who don't intend to take much trouble about cooking.

Steinmetz's attitude toward food was an example of his habit of simplifying human problems as if they were the private wants of electrical apparatus. An induction motor seemed to him much superior to the human body, so much stronger and so much more useful. Its requirements in the way of current, lubrication, and cooling could be accurately calculated. Why not the same with the needs of the human body?

"So," he would say, unwrapping a brown-paper package, "to sustain life the human body requires only three raw materials. Potatoes provide the carbohydrates. Steak provides the protein. And the

fat comes from the butter the steak is fried in. What more can be done? It is complete."

He never got tired of this standardized ration and never could understand why others did.

First Step Toward a Family

LIFE in the laboratory went along smoothly for a time. Steinmetz was as pleased with his estate as a child with a new toy. He puttered about contentedly. He worked long hours at night with no one to complain and threw his cigar ashes wherever he wanted to. Eventually, however, he felt the need of human companionship. Steinmetz was mentally self-sufficient to an unusual degree. He needed no one to help him solve his problems and no one to encourage him with a little well-placed praise. But in spirit he was dependent as a child. He needed a cheerful companion —someone who'd make a joke of the housework; someone who'd help him in his simpler experiments and not bother him when he was submerged in one of his waves of devastating thought.

At this time he was working on a magnetite arc lamp, a street light which gave a brilliant bluish glare before the incandescent lamp came into universal use. These ran on direct current and since the current in the house circuit was alternating, some device was

needed in the laboratory to change it into direct. The best for the purpose known at the time was a rather complicated and tricky affair which needed constant expert supervision or it would go on strike. Steinmetz didn't want to have to look after this machine and run his experiments too, so he called on the company for a man who could do this and who would be of general use around the laboratory. He had done this before and there had always been a rush for the honour. To work with Steinmetz meant to learn more than could be learned in any other way. He couldn't help teaching as he talked and he talked a large part of the time.

The man who came up to take care of the rectifying machine was a young engineer named Hayden. He was an agreeable young fellow, and he knew his business. Steinmetz got along well with him from the start. Presently he was doing little extra things for his young friend. He'd hesitantly ask him to stay to dinner. Give him some of his own horrible cigars. And finally, since much of the work on the street lights had to be done at night and Hayden lived in another part of the city, Steinmetz offered him the other small room upstairs and promised to do what he could for him in the way of meals. As any other young engineer would have done, Hayden accepted

with joy. Steinmetz had curious ideas of personal comfort, but here was too good a chance to miss. All the rest of the gang down at the works would envy him. There was no more valuable experience than working with Steinmetz.

The new arrangement worked very smoothly. Hayden took his share of the housework and helped more and more in the laboratory as he learned more of the master's methods. He never penetrated into the inner circles of Steinmetz's mathematical reasoning but there were few men alive at the time who could, and he shouldn't be thought less of for that. In many ways these two diverse characters fitted together very well.

All this time the new house was being built. Steinmetz took more interest in it now that he had someone to live with him. He made it even larger than he'd planned for now he didn't fear the loneliness so much. As might be expected the house wasn't done on time. Steinmetz hadn't the secret of jolting reluctant carpenters out of their sauntering ways. So for more than a year Steinmetz and Hayden lived in the laboratory at the back of the lot, watching the skeleton of the house rise between them and the street. Each watched with interest, each with some doubts, and each made certain plans.

So, We Called Him "Dad"

EVENTUALLY the new house was finished. It was a somewhat curious-looking affair in what called itself the Elizabethan style. It was very large with huge rooms connected by wide doorways. When it was done Steinmetz found himself rather appalled at what he had brought into being. As he looked through the empty echoing rooms he felt very small and lonely. Hayden, to be sure, was still living with him in the laboratory at the rear but he had a suspicion that the arrangement wouldn't last forever. Normal young men have a way of geting married. Hayden was very normal.

After a look around his empty new house the laboratory seemed very friendly and homelike in comparison. He went back and started cooking the usual steak and potatoes over the gas burner. Hayden came in and ate his meal in silence. The same old steak and potatoes! It didn't seem right to be eating steak and potatoes in a little hole while such a fine big house with a great kitchen and all the things a house should have was standing empty crying for an occupant. But Steinmetz wouldn't move in. He felt lost in the empty rooms. He much preferred the messy laboratory where his peculiar personality had made a nest for

itself out of copper wire, dog's-eared reference books, and burnt cigar butts.

This is how Hayden tells the story:

"The life in the lab was all right, but I was getting sick of it. Steak and potatoes every day. Just steak and potatoes. Sometimes just steak one day and just potatoes the next. I couldn't stand it. So I said, 'I'm going out and get married.' The Doctor said, 'You'd better. Go ahead.' So I went out and got married and we went to live over on the other side of town. About the first night we were back from our trip a knock came on the door. It was the Doctor. You couldn't shake him. We asked him to stay to supper and he did. He used to come around nearly every day and pretty soon he asked me and Mrs. Hayden to come and live with him. You see, he wanted someone around the house. We moved in as soon as we could get some furniture, and we've been there ever since. From then on I always called him 'Dad.' He was like a father to me and Mrs. Hayden."

For the Curious

ONE of the first questions asked about Steinmetz is: "Did he ever marry?" This usually in a challenging tone as if the questioner knows the answer already but wants to hear some interesting details. Perhaps

a determined Freudian could find some but they would be unjust and completely misleading. Steinmetz was so aboveboard in all his relations that the business of pulling him apart in search of obscure motives is a very unprofitable one.

In matters relating to sex Steinmetz never grew up. Perhaps he decided not to. He was capable of it. At any rate his reactions to the whole subject were never those of an adult. To borrow a word from the vocabulary of psychology he "sublimated" his sex impulses into scientific enthusiasm. Mathematics occupied completely that central part of his mind which if he had been a normal man would have been dominated by sex.

Through his adoption of a son and through the birth of the son's children Steinmetz achieved as many of the advantages of marriage as his physical defects allowed. He had a pleasant home, a pleasant group of grandchildren, and a posterity to which he could leave his life accumulation of position and prestige. He wanted no more and what he got was a great deal.

Nor did this mean that he was a repressed person who reluctantly gave up a mode of life which he knew he could not lead. He was never sour on this subject or any other. He had a great stock of human appreciation. He liked women when he felt that they

liked him. He loved to have his house full of young people. A pretty girl was always welcome because of the atmosphere of gaiety which pretty girls always bring with them.

The proof that Steinmetz never grew up may be found in the list of favourite books which he once gave to a newspaper syndicate. Here it is: *The Odyssey,* Homer; *Faust,* Goethe; *Odes and Other Poems,* Horace; *History of Rome,* Mommsen; *The Jungle Book,* Kipling; *Treasure Island,* Stevenson; *Darkest Africa,* Stanley; *Tom Sawyer* and *Huckleberry Finn,* Mark Twain; *Mr. Midshipman Easy,* Captain Marryat; *The Deluge,* Sienkiewicz.

Needless to say, the first four of these are to be taken with a slight amount of salt. Often such a list of books is little more than the reflection of academic opinion. If a publisher were bringing out these ten books he would say that the first four were there to "dress up the list." It is to Steinmetz's credit that more than half of his choices were genuine. The first four he included because he felt he ought to. The last six were more to his taste. These he read over and over again, eking them out with detective stories and dime thrillers.

These six books contain a minimum of "sex interest." He didn't like to read about love and passion because he had never felt these emotions himself. He

preferred stories of adventure and travel. The books he chose as his favourites are the highest examples of the "thriller" type. Steinmetz was sorry there weren't more of them. He had to read dime novels because there wasn't enough Sienkiewicz.

His taste in movies was similar. No sex stuff, just "good clean action"—lots of it. He liked above all others the old-fashioned Western films, where the hero kills bad men before breakfast. He went to every Western which came to Schenectady, and when Douglas Fairbanks was in town not even the call of his laboratory could keep Steinmetz out of the movie house.

These literary and dramatic tastes are those of an intelligent and discriminating boy of fourteen. The books he chose are the best of their limited type and the action movie is a natural favourite with normal boys. Long before motion pictures were invented games of make-believe took a similar form. Steinmetz couldn't play "Indians" at the age of fifty—never could for that matter. But the weight of the years dropped from his shoulders when he sat down in a movie theatre and saw the first bad man blaze his way across the screen. The little-boy spirit in Steinmetz never died. The emotional interests of maturity never grew strong enough to kill it.

PART FIVE

THE HIGH PLATEAU

THE HIGH PLATEAU

Some Gilt Edges

SHORTLY after this indirect acquiring of a family Steinmetz received a series of honours which put the finishing touches on his self-esteem and placed him firmly on his pedestal of prominence. In 1901 he was elected president of the American Institute of Electrical Engineers and in 1902 was made Master of Arts by Harvard University.

The ceremony of conferring this degree must have been picturesque. A Harvard commencement is an exceedingly formal affair. The faculty wear the brilliant gowns and hoods of universities all over the world. The sheriff opens the show with a short formula in Seventeenth-Century English. The background is the dull black of the students and lesser faculty members. The president stands on the platform in gloomy, panelled Saunders Theatre and confers each important degree with a short formal speech.

It is said that Steinmetz went to this august occa-

sion in his ordinary business clothes, which most men would have been ashamed to go fishing in. He painfully hitched up the steps to the platform. President Eliot stood there majestic as usual, smiling down from his six feet two, as if he were a tolerant visitor from another planet. He proffered the tightly rolled degree.

"I confer this degree upon you," he said in his deep voice, "as the foremost electrical engineer in the United States and therefore in the world."

It was a typical Eliot speech. It made the giving seem more important than the receiving, and the receiving seem very, very momentous.

The ceremony pleased Steinmetz very much. He appreciated the honour from the most ancient and lofty of American institutions as only a poor immigrant can. He had done his best to become American in spirit, in name, and in fact. Here was proof that he had made a place for himself in the esteem of his new country.

A year later he was made Doctor of Philosophy by Union College in Schenectady and was asked to be Professor of Electrical Engineering. This on the whole was a lesser honour in the eyes of the world but the results were more tangible, nearer at hand. Steinmetz, on going to work, could walk through the

beautiful grounds of the college and feel that he had a part in the activities around him. He was Doctor Steinmetz now, and Professor Steinmetz to the students who came to hear his lectures.

So when he moved into his new house he could smile at the world with a new feeling of completion. He had raised himself to the top of his profession and was recognized there by the highest intellectual authority of his adopted country. His economic position was without worries and he had even acquired a family and a fireside—something he'd hardly dared dream of before. He began to see less curiosity in the stares of the people on the street, and more admiration.

Pearls Before Undergraduates

WITH his usual enthusiasm Steinmetz took up his new duties as college lecturer. He knew nothing about it, of course, and lecturing to undergraduates is as specialized a profession as acting on the vaudeville circuit. You have to hold down the writhing, unwilling minds with one hand while you cram knowledge into them with the other. Undergraduates have a way of drawing in their ears until they become round, perfectly polished—until words glance off them harm-

lessly. Steinmetz brought a new and perfectly innocent method into the lecture room. He was rewarded with a certain amount of unexpected success.

Those who attended his lectures remember vividly the remarkable appearance he made on the platform. He looked out of perspective, as if he were a long way off and moving with wonderful rapidity. He would write nervously on the blackboard, talking all the time, and then without missing a word whirl round in a tempest of questions. After the first fifteen minutes the minds of the students became rather numb. No one ever followed him in all his calculations. He'd plunge into a flood of figures like a diver into a whirlpool; he'd struggle furiously with weird symbols which meant nothing at all to anyone but himself; he'd cover the board with writing too small to be seen beyond the first row, and finally he would emerge with a conclusion which should have been on Page 347, two chapters ahead.

The students got very little actual mathematical information out of his lectures but they did get a great deal of inspiration. And mathematics in its higher forms is very inspirational. The sight of the little man on the platform there, bursting with enthusiasm and performing chalk miracles before their eyes, was enough to put energy into any ambitious young engineer. There aren't many lecturers

like Steinmetz. If there were, no one would learn anything definite. But one Steinmetz in the intellectual adolescence of every man would make that man higher minded and less apt to become a mere stodgy technician.

This connection with Union College lasted ten years and amounted to a rest from the more strenuous duties with General Electric. So great was the latitude allowed him by the company that he could carry both jobs at the same time. Then, too, the company regarded the scientific department of Union College as almost part of its own research laboratory. It knew that Steinmetz's real energy was going into his work with electrical calculation and that it would finally reap the benefit of his labour.

It can't be said that Steinmetz took his lecturing very seriously or did it very methodically. The learning process had been so easy in his own experience that he overestimated the learning capacity of his students. Yet he almost made up in personal magnetism and enthusiasm for what he lacked in method. He rarely prepared his lectures beforehand and often had the haziest idea of what he was going to say before he got on the platform. Often his talks were mere thinking out loud—inspiring in the last degree but far over the heads of his students.

As one of his hearers said, "Everything was as

clear as day while he was still talking, but the minute he stopped the fog rolled in."

Steinmetz was all too apt to give others credit for an appreciable fraction of his own ability.

Mathematical Voyages

THIS period in the 1900's was the happiest one in Steinmetz's life. He was made happy by small things, not large ones. And there were plenty of pleasant little things around him now.

In the first place he was more and more associated with youth. This was the companionship he loved best. The Hayden children, three of them, were growing up to call him "Granddad," and they were growing up too without the feeling that his deformity was unpleasant or ridiculous. A child who has owned a dachshund for a number of years thinks all other dogs are too tall. It was a wonderful thing for him to have near by three agreeable young people who had never experienced the shock of seeing him for the first time.

As the children became old enough to be taken down to the camp on the Mohawk, this delightfully ramshackle hangout began to show more and more possibilities. He bought a number of very small canoes

and very small double paddles. They fitted him and the children equally well and he felt here was a kingdom of his own where coarser beings couldn't follow.

The camp was built near the mouth of a small, shallow stream called Viele's Creek. It had a stony bottom and was not very long, but Steinmetz felt that if he dammed it up a bit there would be plenty of chance for the kind of canoeing he loved. So he used to ask dozens of men out to the camp on Sundays and made them work on the dam. Gradually it grew and a little placid pond grew behind it. The creek deepened and the current almost disappeared. You could push and paddle a canoe all the way up to where the trees met overhead as if there were no creek dividing the forest. The little pond was sunny and calm and the water splashed happily over the rough stones of the dam. Steinmetz would drift around in his absurd canoe as happy as a floating chip and as free from worries.

Here he came to do a good deal of his work. He'd take a broad smooth board and lay it over the gunwales of his favourite canoe. He'd carefully fill a large box with his famous cigars and place it on a pile of paper. Mixed with the cigars were well-sharpened pencil stubs.

Then he'd push off into the pond, lay the paddle

between him and the writing board, and drift placidly for hours, hunched over his work, with the sun beating down on his back and the clatter of the numbers in his head mixing with the sound of the water falling its brief two feet over the little dam.

This was how he loved to work best. He'd drift for hours, apparently impervious to interruption. The children and their friends might be swimming in the pond, making waves which rocked his little canoe. They might be fighting uproarious battles with mud balls over his head. They might even push his canoe away when it came into too dangerous waters. He'd look up perhaps with his naïve and kindly smile. But a moment later he was lost again in the wilderness of figures he alone knew how to traverse.

Some scientists when at work need enough paraphernalia to equip a good-sized factory. But not so Steinmetz. All he asked was a pencil, plenty of paper, a lot of cigars, and a five-place table of logarithms. With these he would work all day happily in his canoe, and when at dinner time a few brisk strokes brought him ashore the electrical world would be richer by several formulæ.

One day when he drove out to Camp Mohawk for a day's work he left his book of logarithms behind in Schenectady. There was consternation among the

Haydens. Logarithms are the fluid medium as necessary to mathematical procedure as water is to a steam engine. And a five-place table is a good-sized book packed jam full of monotonous figures. The Haydens began reconciling themselves to the long trip back to town.

But Steinmetz wasn't disturbed in the least. He went on sharpening his pencils and filling with cigars and matches the wooden box which accompanied him on all his canoe voyages of mathematical discovery. He placidly went down to the water's edge and began launching his canoe.

Hayden called down from the porch: "I'm going in town for those tables. I'll be back in an hour."

Steinmetz pushed off from the bank without looking back. "Don't do that," he said mildly. "Guess I know that table by heart. I haven't had to look into it for weeks. Bring it out to-morrow though. I may make a mistake sometime."

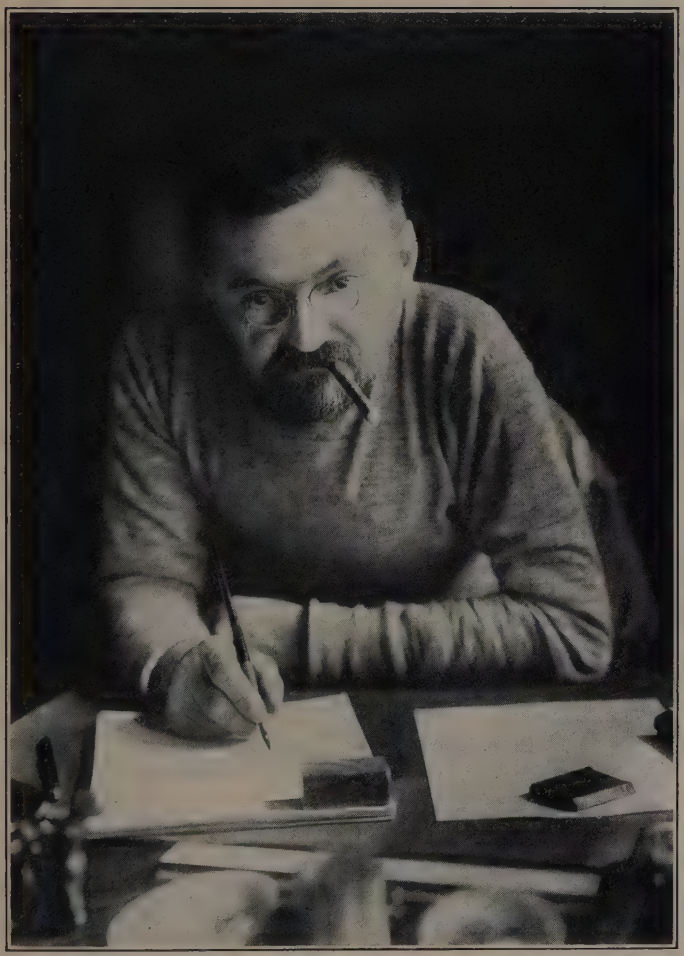
There was silence from above—the silence of almost superstitious respect. Hayden shuddered as he thought of himself, tongue hanging out, lost in that parched desert of endless figures. Then he looked down at the little hunched person paddling slowly out into the creek. Steinmetz wasn't worrying about anything like that.

Concerning Band Saws

BUT not always did Steinmetz's mind run as smoothly as this. It was a specialized machine well fitted to its work but sensitive to shock and easily set running the wrong way into hopeless confusion. The more highly developed a machine becomes, the better it does the special task assigned to it, but the worse it does the numberless other secondary tasks expected of the simple tool its ancestor. Now an ax is a simple tool. It does a great many things pretty well. It cuts down trees, squares timbers, chops kindling; it can even sharpen pencils or be pressed into service as a wedge or a sledge hammer. It's the ideal tool for the castaway on a desert island.

If we take one of the special tasks assigned to the ax and develop a tool which can do it better, we find that we have a specialized machine which will do little else. An ax, for instance, will square timbers but not do it well. A double-acting band saw does it a great deal better and a great deal faster. But if anyone expects a band saw to sharpen pencils or drive fenceposts—that person shouldn't own a band saw.

So it was with Steinmetz's mind. It was marvellously adapted to its special task, which was reasoning perfectly and rapidly along definite mathematical lines. It could rip through problems as fast as the



Courtesy of General Electric

PAPER, PEN, AND CIGAR

band saw rips through logs, and could stack up perfect solutions as fast as the band saw stacks up sweet-smelling boards. But every once in a while, humming along smoothly in its chosen medium, it would hit an unexpected nugget of glass-hard human emotion. Has anyone seen a band saw encounter an embedded spike? It isn't pleasant.

One summer day Steinmetz went down to his camp with a number of friends, among them a young Dutchman. After lunch there wasn't much to do and the Dutchman thought it would be a good idea to blow up a certain stump which blocked the doorway. There were some shotgun shells in camp, but he decided that the powder in all of them would not be enough to produce an impression. So he hopped into a car and dashed back to the plant to get a stick of dynamite. There was, no doubt, plenty of dynamite around the General Electric works but the Dutchman found it wasn't easy to get hold of. Explosives are usually in the care of some pragmatic soul quite out of sympathy with amateur scientific enthusiasm. Not at all discouraged, he did the next best thing. He went to the drug store and bought a quantity of potassium chlorate and a package of powdered sulphur. These if mixed together will produce an effect well known to every small boy with careless parents. The Dutchman was a small boy at heart. It was too bad he

hadn't studied chemistry instead of engineering, for no chemist will have potassium chlorate around loose and he certainly won't mix it with anything at all.

Returning to the camp, the Dutchman poured the chlorate into a bowl, added the sulphur, and began mixing them together with a kitchen spoon. The chlorate was lumpy. He had to press down rather hard. Suddenly there was a flash and a detonation. The bowl was shattered into numerous pieces, the table top was splintered, and the Dutchman fell back on the bed, his face covered with blood and his hair full of blue burning sulphur.

He was very badly hurt but let's not spend too much time weeping for him. The effect of the disaster on Steinmetz is more interesting. As soon as the smoke and fumes had cleared away two of the men ran to help the victim. Others went for water, another for a doctor. Another, now a leading figure in electrical engineering, stood ready to help but with little enough to do. He had the opportunity to observe what happens when a band saw hits a spike.

Steinmetz's whole mind was shattered with excitement. He hopped around the room quite beside himself. He stood on chairs—on the bed. When the accident occurred he was talking easily in his fluent English. A minute later he was jabbering in German and presently he had forgotten even his mother

tongue and was chattering shrilly in no language at all—incoherent, disconnected sounds, shrieking abstract terms—a primitive speech which was pure primeval emotion with no reasoned words to temper its emphasis.

It was a perfect demonstration of the drawback of too great specialization. The other men were not nearly as great scientists but they remained moderately cool. At least they became cool in a short time. But Steinmetz had reverted almost to the primitive. The secondary functions of his organization had atrophied to such an extent that they were quite useless. Instinctive reactions did not take place in the crisis. He was a sailor cast away on a desert island with nothing but a double-acting steam band saw.

Sports

ONE way to explore the character of a man is to observe what games he plays. If he tries to develop skill as a social asset there isn't much you can deduce except that he's not very sincere, but if he really likes a game you can get quite a look inside the outer layers of his personality.

People with rudimentary and unoccupied minds are apt to play a great deal of bridge. It takes little actual mental effort but gives the illusion of tre-

mendous complication. It has produced a brood of rather useless technical terms which slip easily off the tongues of those without ability to learn a vocabulary with real meaning. The mere holding of a good hand or the laying down of a helpful dummy affords intense satisfaction of a sort.

For a normally intelligent person, playing a good game of bridge is hardly more than paying attention to what cards have been played and acting accordingly. The human element doesn't enter at all. Which makes the game a godsend to matrons with social inclinations but no social talents.

It is rare to find a man of truly great mind who is also a frantic bridge player. He soon exhausts the meagre possibilities of strategy; soon tires of the feeble thrill of picking up his cards, and soon deserts the game for one which doesn't hold him down with an iron hand to the level of the rocking-chair brigade.

If an unusually intelligent man really wants a game to occupy his leisure moments there are two which can be made to fill his need. These are chess and poker. Quite a lot can be deduced about a man if he becomes devoted to either of these.

Chess is a pure game of mind. The personalities of the players meet only through the pieces. The game can be played by letter or telegraph as well as with a single board. The player is solitary in his thought.

He does his opponent the compliment of thinking him capable of every possible move, however intricate.

So chess is apt to be the game of contemplative and self-sufficient men. There is no reassuring smile from a partner, no starting advantage of a good hand, no possible run of luck. His mind is alone in a vast and dangerous land peopled by untrustworthy knights, diagonal bishops, and insidious pawns. It is no game for a man craving human companionship. The controlling intelligence of the opponent is infinitely remote. Each moving bit of wood has a perfect intelligence of its own with no human weaknesses to be appealed to.

Poker is the antithesis of chess. It is a game entirely of chance and personality. The mathematical probabilities can be mastered in fifteen minutes. The rest is luck and understanding of the lower octaves of human nature.

It was natural that Steinmetz should play poker and not play it very well. His intellectual cravings were fully satisfied by his expeditions into mathematical universes where few could follow. He had no need for the mental exercise which chess affords. And he did have a crying need for human companionship.

A friendly poker game is a social function of a

sort and Steinmetz was placidly happy when playing in one. His defects of body were out of consideration. His peculiarities of mind were sidetracked for the time. And the lofty superiority of part of his intellect was not sufficiently noticeable to stir up envy and hatred in those not as sensationally equipped.

For years Steinmetz's main social delight was a poker club called like thousands before and after it, "The Society for the Equalization of Salaries." The other members varied from time to time as the General Electric engineers came and went, but Steinmetz was always to be seen, kneeling happily on a chair in a cloud of cigar smoke, his elbows on the table and a blissfully naïve smile on his kindly face. The stakes were never high but Steinmetz kept the accounts carefully in a ledger. Every so often the winnings and losses were balanced up and the scores settled.

When this was done Steinmetz showed a strange unwillingness to pay his debts. It seemed unlike him and was much discussed among the other members of the club. He was the very soul of generosity and money meant little to him. If one of the men to whom he owed ten dollars had been in need of a thousand Steinmetz would have done his best to help him out. But when it came to the little debts written down in the book he squirmed, and squirmed, and delayed.

The reason for this is to be found in his attitude toward the game. Most men play poker for the opportunity to win some money. Their real interest is in the big pot, not the game itself. Not so with Steinmetz. He cared little for money, or even for the game as a game. What he loved was the contact of personalities. Haggling over the accounts was part of this. In his Harlem days he squabbled with Asmussen over who should do the dishes. He enjoyed the squabble for its own sake. He would have rather washed a thousand dishes than offend Asmussen. Now with the poker debts it was the same. If they had been larger he would have paid at once, even if he had had to mortgage his cacti.

Believe Ourselves as Others See Us

If Steinmetz had been given to thinking about such things it would have seemed a weary long way from his peaceful laboratory and pleasant camp to the raucous world of publicity where the papers day after day shouted silly things about him in every hamlet large enough to have a paper. But he didn't think much about them and so when he finally subscribed to a clipping bureau the flood of newsprint which descended on him elicited only a mild non-

analytic pleasure such as a child would feel when praised by a not especially admired teacher.

This clipping bureau had a motto—still has in all probability—which shows a good deal of imagination in some member of the firm but which would be fatal to take too seriously. It is the famous quotation from Burns:

> O wad some power the giftie gie us
> To see oursel's as ithers see us!

At first Steinmetz laughed at the very idea. He had no greater opinion of the newspapers than any other scientist who sees his most perfect theories distorted beyond all recognition to fit the feeble minds of the Sunday readers. But year after year the clippings arrived in every mail. The motto was always pasted at the top with the name of the paper and it had a powerful subconscious effect. Finally Steinmetz began to fit himself into the mould manufactured for him in the copy rooms. The mirror of the public eye always distorts but it usually flatters, and by flattery impresses its influence.

These clippings were made up for the most part of two themes, an unbounded admiration for his accomplishments and an equally unbounded interest in his peculiarities. It was only natural that he should gradually come to believe that these peculiarities

were not only excusable but were somehow bound up with his success.

One summer day in the early 1910's, all Schenectady was excited. The Russians were coming. At the time, to the average American of the time Russia was a rather vague and terrifying thing. It was compounded of the horror of Siberia, the glitter of the Crown Jewels, and the depressing gloom of the Russian novelists. Schenectady had never seen a real Russian. Of course there were plenty of poor bohunks doing the dirty work down at the plant, but they fitted into the picture so poorly that they were not considered real Russians. They wore neither Cossack boots nor Crown Jewels.

So when the news got round that a delegation from Russia was in town to go over the General Electric plant all the big men in the company were on the alert. They visualized half of Asia cross-hatched with power lines and computed the number of generators necessary to keep them charged.

The Russians arrived. They were neither horrible nor gloomy, but they wore the Crown Jewels in the form of cutaways and high hats. They paraded solemnly around the plant, showing polite interest in the powerful machinery and expressing wonder at every device which they did not understand. When they had seen everything else they asked to see Stein-

metz, whose fame had long ago penetrated to St. Petersburg.

There was much frantic telephoning from Building No. 6 and Steinmetz was finally located at his camp. There was no telephone there and so a messenger was rushed out to tell him to prepare for the august visitation. The bosses astutely judged that the Russians would get more kick out of seeing him in his native haunts than starched and uncomfortable in the office building.

Steinmetz got the message and prepared for the visit in his own way. He was in a bathing suit and working blissfully in his smallest canoe. He remained in the bathing suit and continued to work in the canoe. The Russians drove up in a glistening car, were guided down the precipitous path, and waited while Steinmetz climbed up from the water's edge to meet them, the usual thin cigar sticking out from his face like a dead twig. He looked very queer in a bathing suit—his deformities were magnified and his body seemed even smaller than it was. But his forehead was as fine as ever and his talk even better than usual. The Russians were charmed, high hats and all. No doubt they took back to Russia the memory of this scientist who had sufficient confidence in his brains not to care what the rest of his person looked like.

This story spread all over the city. The executives

who had dressed their best to greet the visitors admired Steinmetz's nerve in not doing so. "Isn't it just like him?" they said to each other. But it was not like him. The incident would never have happened if it hadn't been for the homœopathic doses of clippings which he had been taking for the past few years. His informal dress at the Harvard commencement had been mere ignorance. It was not deliberate. Like all shy men he was naturally nervous about appearances and afraid that something would be taken amiss.

But all this was changed by the shower of clippings which praised equally his scientific achievements and his peculiarities. If you look too long at your image in the mirror of the public eye you become distorted to fit the reflection you see there.

Some Sympathetic Playmates

As STEINMETZ became more able to indulge his whims his house took on a strange appearance. The nightmarish greenhouse had grown a good deal and was even more crowded with weird thorny shapes. And to make matters worse its loving master had installed mercury vapour lamps which threw a ghastly, blue, shadowless glare on every monstrous plant. Steinmetz used to putter around happily under this horrible light, admiring the brilliant green which

it gave to the cacti. It was good for them too, he would say. The light was very actinic.

And the place was swarming with animals. They weren't the common household cat and dog. Although at one time there was a very humorous and educated mongrel, Steinmetz was far fonder of such creatures as appealed to his sense of the grotesque. Sometimes there were as many as five alligators crawling among the cacti or swimming in the lily pond in the centre.

Once these alligators all escaped. For days Schenectady hunted for them. The city was swarming with them. Every nervous woman and scary child saw several in each dark corner. Children were forbidden to swim in the river and older boys stampeded for shore at the sight of a floating log. Of course most of the alligators were small enough to be totally harmless but the Steinmetz legend had grown to such an extent in the minds of the neighbours that they believed him capable of playing with a dozen ten-foot ones. They were all captured finally and comparative peace reigned in the conservatory.

As it became known around the country that Steinmetz appreciated live gifts the collection of freak animals grew rapidly. When a family got tired of caring for an unusual pet it was apt to be passed on to Steinmetz, who was sure to give it asylum. Sick ducks and undersized kittens arrived in swarms.

Small boys would shyly offer feebly paddling mud turtles. At one period there were two crows adding their raucous croaks to the crawling silence of the reptiles. The climax was reached when the Gila monster arrived from the West.

Few people have seen these horrible creatures or even dreamed that such a sluggishly dreadful beast is possible. They are large slow lizards from the deserts of Arizona. Their heads are blunt and almost as large as their thick bodies. Their tails are blunt and almost as large as their heads. They are covered with what appears like red and black beadwork arranged in irregular broad stripes. Their eyes are generally closed and they are usually sleeping in the sun, but when they open their eyes and look ill-naturedly at the world they can express in one flick of their scaly eyelids all the torpid evilness of Nature in her most brutal and hideous mood.

Gila monsters are said to be poisonous. They have no hollow fangs or poison sacs like the snakes but in their lower jaws are two long teeth, deeply grooved. When the creature strikes, and in its native sunlight it can make a short series of movements with lightning rapidity, it fastens these teeth in its victim and hangs on with a bull-dog grip. Then it turns over on its back. The poisonous saliva runs down the grooves

while the creature chews steadily to insure deep penetration.

This is the gentle pet to which Steinmetz was most deeply attached. He kept it prudently in a cage in the conservatory where it slept all day under the glare of the mercury lamps. He used to say that it represented the ultimate in biological economy. Every year he'd place a dozen eggs within its reach. Once a month it would wake up and eat one. The eggs lasted a year and the creature never seemed to need anything more.

Humour

For the subtler forms of humour, based as they are on the more delicate shades of human emotion, Steinmetz had little understanding. But horseplay and practical jokes were his eternal delight. To please him a joke didn't have to be very complex and a favourite trick never grew less funny if repeated ten times on the same person. One of the most eminent electrical men in Schenectady is said to have stumbled a dozen times over the same protectively coloured box on the threshold of Steinmetz's laboratory. He didn't think it was funny the first time and the twelfth time he thought it decidedly tedious but Steinmetz was just as delighted the last time as the first. He

laughed every time that man came into his laboratory, even on those rare occasions when there wasn't any painted box for him to stumble over.

Not long after this enterprising practical joker had established himself in his own laboratory some misguided person sent him an old-fashioned static electricity generator. It was no use in his work, as there are vastly better modern means for obtaining the same results, but as a joking instrument it was much appreciated. From then on it was a daily sight to see dignified visitors leaping from their chairs or drawing long sparks from an innocent-looking door knob. Steinmetz even charged himself so that a person shaking hands with him would receive a shock.

At this stage of Steinmetz's humorous development no one came into the laboratory without certain precautions. A visitor would look carefully to make sure that the chair he sat in was not supported on unglued legs. He was on guard against trick cigars and curious things to eat. And above all he didn't expect to get out without at least one shock from the static machine.

Steinmetz was usually very chivalrous and respectful toward women but there was one trick which he delighted in playing on them. He had part of his establishment lighted with the same mercury vapour lamps which made things hideous in the conservatory. Near a doorway he placed a full-length mirror. When

any girl came to the house whom Steinmetz suspected of being proud of her looks he would carefully manœuvre her to the doorway and turn on the mercury lamps. The expression on the girl's face never failed to delight him. Reflected in the mirror, she would see herself with ghastly green skin and dark purple lips—rather as if she'd been dead for two weeks.

Steinmetz said this proved everything was relative.

Business

A REPUTATION for generosity is all very well but if noised about too extensively it can become a terrible nuisance. Steinmetz not only had such a reputation but he deserved it, which is quite another thing. A hard-luck story didn't have to be very hard or even very plausible to get sympathy from him. His charity list was a tremendous one and contained all varieties, from palpable frauds to really deserving unfortunates. Whenever there was a "drive" the canvassers came first to Steinmetz, who never refused or even listened long enough to learn what good cause the collection was to benefit.

Also he had a bad habit of indorsing notes. He never realized fully that to indorse a note or a check for a person of no financial responsibility is in effect

to lend money without a chance of getting it back. Every hopeless deadbeat, if he could only produce a story of injustice, was sure of some financial help. Socialist deadbeats were particularly favoured. Often Steinmetz's bank account declined almost to zero, but the company, in its fatherly manifestation, helped him out and ordered his confused affairs.

If it hadn't been for the watchful care of the General Electric, Steinmetz would have bogged down a dozen times. The far-sighted company realized that with his uncanny ability and God-given talent for inspiring publicity he was one of its most valuable assets. The officers didn't propose to let him get involved in too distressing financial messes.

The worst tangle in which Steinmetz involved himself was with a company which proposed to manufacture an electric truck and wanted him to design and indorse it. No doubt the intentions of this company were good. Most great corporations start with an idea and collect more tangible assets later. This one counted Steinmetz's support as its first and most valuable possession. It never achieved the great success freely predicted for it and it set in motion a chain of legal complications which bothered Steinmetz and his employers for many years. The whole business was a rather sordid commercial wrangle not worth going into here but the motives which caused Stein-

metz to enter the firm are worth describing in some detail, for they illustrate the impractical and dogmatic side of his nature.

Now Steinmetz was a very doctrinaire person. He had a way of thinking out theories on subjects he knew nothing about and sticking to them through thick and thin. In his own specialty he was very open-minded and rational but elsewhere he'd jump at conclusions without thinking twice.

One of his doctrines was about electric vehicles. When automobiles were coming into use the roads outside the cities were very bad indeed. They were plain dirt for the most part, dusty in dry weather, muddy in wet weather, and rough all the year round. Touring on them was an adventure and an ordeal. So Steinmetz, reasoning as usual over his restricted area, evolved the following theory:

"Automobiles," said he, speaking in 1914, "are now a fad. Like bicycles they will remain a fad for a number of years and then will be dropped by those in search of amusement. After that they will be adopted by the ordinary man as a means of getting to work. The bicycle was quickly reduced to the rank of a humbly useful device. The automobile will be too.

"Now the advantages of the gasoline engine are high power, high speed, and ability to run a long time without stopping. The advantages of the electric

motor operated by a storage battery are simplicity, cheapness, and reliability over short distances. Presently the rich will get tired of racing at high speeds over terrible country roads. Then the electric automobile will come into its own as the cheapest and most convenient means of getting to work and driving about on the well-paved streets of the larger towns. It can be charged at night in its own garage, and since it can be run thirty miles without recharging, it will have to be charged only then."

Logically this theory is correct. The advantages of the two types are accurately evaluated. The theory as a whole, however, is totally wrong because Steinmetz left out of consideration those human factors which he was himself unable to appreciate. He could not believe there was any real pleasure in speed. He couldn't realize that people enjoy the freedom of a car which makes them their own master over a radius of several hundred miles a day. Steinmetz was contented with the little beaten track between his home, his laboratory, and his camp. He hadn't an ounce of adventure in his make-up. He couldn't believe that anyone else had.

So when a group of plausible and persuasive men came to him about a great new company which was going to manufacture an electric truck and wanted to use his name and his brain he was inclined to listen.

The proposition sounded good as a business venture, and it might vindicate his theory, which was being disproved daily. So he gave the company permission to use his name, agreed to sit on the board of directors and to help with engineering advice.

It would have been all right if it had stopped there. Using a great name to promote an uncertain enterprise is considered good business ethics. But the directors at once started a high-pressure stock-selling campaign. Somehow they got hold of a list of the General Electric stockholders and sent to each one a letter telling about the fortunes to be made by the stock and calling attention to Steinmetz's connection with it. A good many shares were sold. The General Electric stockholders were proud of their company and were confident that the most famous man in it would not be mixed up in anything but a sound venture.

This was where the General Electric felt it ought to take a hand. It published a statement disclaiming any connection with the truck company and warning the public against buying its stock merely because the most famous scientist in the General Electric was sponsoring it. The statement was carefully worded to avoid any suggestion that the company was not absolutely on the level but the inference was that Stein-

metz had allowed too many liberties to be taken with his name.

No doubt the truck designed by Steinmetz was a good one. The demonstration models performed well and proved themselves economical. But they were not destined to become popular. The gasoline engine offers too many advantages. If the electric truck had been vigorously pushed a few years later it might have found a limited usefulness on the congested streets of the larger cities. But since traffic then was not what it is now the electric truck didn't capture even this market. Steinmetz lost a good deal of money and was worried for a time by a sordid damage suit from a promoter who claimed credit for floating the scheme. If the General Electric hadn't taken a hand in the business he might have lost heavily in reputation too.

But he never gave up his faith in electric vehicles. He drove one himself as long as he was physically able.

PART SIX

POLITICS

POLITICS

Pacifying a Socialist Conscience

IF THERE was ever a person unadapted to a political career it was Steinmetz. But he did run for office several times and met with a certain amount of unexpected success.

To understand his rather peculiar political opinions we must go back to his life in Germany while he was a student at Breslau. There he was an under dog. The future looked dark and unpleasant to him. Germany was not so bad a place for an ambitious son of a workingman. There were plenty of ways for him to rise above his station and of these the career of a scientist was perhaps the easiest, for Bismarck had seen the important part which science would play in the elevation of the German Empire to world power. But a young student, physically handicapped, friendless for the most part, and without money or prospects, might easily in any country conclude that, since he was having a hard time, the social system was all wrong and ought to be changed. This is the root of most Socialism. The leaders of the party may

be sincere economic theorists, but the rank and file are made up of those who want the rules of the game changed so as to make their assets and abilities more valuable. If the pitchers had their way baseball would become a throwing contest. Steinmetz wanted the rules of society altered so that brains would count more and social charm, physical attractiveness, and ancestry less. He was only human in thinking that Socialism would bring about such a change.

I have described in detail his socialistic activity and his consequent flight from Germany. It is interesting to notice that the farther he got from Breslau the more moderate and conservative his Socialism became. By the time he reached this country he had completely forgotten it in the thrill of starting anew in a land which at least tries to be just to a poor immigrant with nothing but ability on which to rely.

Life in America went very well with Steinmetz. Better than he had hoped by far. He quickly obtained those simple comforts he desired and soon became recognized as the leading genius in his chosen profession. What more could a man ask? America was treating him pretty fairly. It wouldn't be right to advocate the overthrow of the society which had so befriended him.

Later on, when he was established in Schenectady, admired by all the world, and courted by everyone

from reporters to celebrities, someone asked him when he stopped being a Socialist.

Jokingly he replied, "As soon as I was making $5,000 a year."

It wasn't as simple as that. Steinmetz was still a Socialist. But political faith took with him the place of religion and like most genuinely religious people he didn't like to discuss it with anyone who might be unsympathetic. Religious people, with the exception of professionals like ministers and Y. M. C. A. secretaries, feel somewhat reticent and on the defensive about their beliefs. Steinmetz felt this way about his Socialism. He didn't like to discuss it with the hundred-percenters. He wasn't a red-eyed radical but he knew that the hundred-percenters wouldn't distinguish between him and the crudest trouble maker down at the works.

Gradually Steinmetz managed to reconcile his beliefs with the evident prosperity and approximate social justice of America. He observed that although capitalism was more firmly entrenched in this country than anywhere else it hadn't developed the usual abuses. Labour was mostly unorganized but was well paid and contented. There was no class hatred except among the immigrants who had brought their ill nature with them intact from Europe. The poor weren't very poor and they spent their energy in

bettering their own condition instead of attacking the rich. All the blessings of Socialism seemed about to be obtained without any of its disadvantages. Steinmetz thought about this for a long time and then characteristically evolved a theory which set his conscience at rest. This theory is contained among other things in his book *America and the New Epoch,* which, by the way, is well worth reading.

"America and the New Epoch"

For the greater part of his life Steinmetz worked for the General Electric Company and received from it greater benefits than he could have obtained in any other way. He was treated like a much appreciated small child. His whims and peculiarities were taken into consideration and his most subtle undeclared desires were quietly gratified. His relations with the company were always pleasant and mutually profitable. And yet the General Electric was then and is to-day perhaps the most highly developed and far-reaching aggregation of capital in the world.

To the average unthinking Socialist this seems almost impossible and certainly all wrong. The Socialist brought up in an atmosphere of class hatred is taught to believe that all powerful groups of capital are bent on crushing the aspirations of their employees. The

figure of a money octopus is always in his mind—an invisible, insidious, and vicious power which has no heart, no soul, and no sympathy with the common man. To such a person it seems incredible that a man could remain a Socialist and yet at the close of his life believe that the large corporation is the most perfect possible form of economic government.

In *America and the New Epoch* Steinmetz's method of reconciling these conflicting economic systems is set forth with unusual clarity. The first statement which compels the attention is about his own experience as a corporation employee. He worked only for Eichemeyer and the General Electric and so can't have had very much experience in this line, but he emphatically states that he prefers working for a large corporation to working for a small one. A large concern operates on a carefully considered plan. It keeps its margin of profit small and relies on a great volume of business for its net profits. It can look broad-mindedly at the matter of salaries. But a small corporation dominated by a single man cannot do this. The owner can't help thinking that every cent paid to an employee is a cent out of his own pocket. The boss is forever parading around the works thinking out ways to reduce expenses. He can't afford to be far-sighted, and the weight of his economy usually falls on the defenseless pay roll. In the case

of Steinmetz none but the greatest of corporations could have afforded to subsidize his researches without applying pressure to make him produce results which could immediately be turned into money. Steinmetz concluded that the real capitalist criminal is not the large trust, which is merely a group of well-paid employees working for a nebulous list of stockholders, but the single business man working for himself alone.

With characteristic passion for completeness Steinmetz polishes his theory and rubs off the rough corners. He adopts two terms to clarify his meaning. The system of *laissez faire* and free competition he calls "individualism." The modern system of large, almost monopolistic, trusts he calls "coöperation." It was economic individualism which Socialism intended to destroy.

The individualistic captain of industry operating under the principle of *laissez faire* was the villain of the Nineteenth Century. He worked only for his own profit. If he chose to treat his employees decently it was so that they might serve him more loyally. His only ends were his own ends and if he didn't pare his expenses to the last penny competition would force him under with disaster both to him and his employees.

The large corporation which has almost a monopoly in its field and yet isn't run for the benefit of a single man or a small group of men is much better for the well-being of society. Its business is so large that its margin of profit can safely be very small. It can think of the interests of its employees and is apt to do so, for the officers are themselves employees and are so considered. When the unit to be benefited by the firm's activity is some hundred thousand employees and perhaps as many stockholders it isn't a good idea to pull any dirty business against society in general. The interests of the company's own dependents are too exactly the interests of the whole body politic.

This development of the small company controlled by one man into the large corporation owned by thousands of stockholders and operated by hired experts Steinmetz named "coöperation." By demagogues it is called "big business" and vilified as the enemy of the common people. To Steinmetz it was the intermediate step toward a bloodless revolution. If these corporations continued to grow and continued to distribute their stock to every worker they would soon become the very structure of the country. The formal government would either have to take control of them or resign in their favour.

Steinmetz liked pat diagrams to illustrate a difficult idea. Here is how he illustrated this one:

First—Competition. 7
Then—Coöperation.
Then—The Big Corporation.
Then—Supervision and Control.
Then—Management.
Then—Ownership.

"And that," said Steinmetz, "is Socialism.

We can imagine him shutting the covers of his mind with a satisfied snap. He had destroyed the contradiction. He could work for one of the most powerful corporations in the world, could be intimate with its officers, could live among them, could be well paid for doing so, and still be a loyal Socialist. His conscience was at rest.

One Road to Utopia

ANOTHER pet theory of Steinmetz's was the four-hour work day. It was customary when he advanced this idea for his associates to ask why, if he believed that four hours were enough, did he often work sixteen hours at a stretch. His reply would be that his strivings in the laboratory were not work at all. They were sixteen hours of pure recreation. Far from being an overworked slave, he was the freest man in

the world. Never did he do more than two hours a day of what in his definition constituted work.

Work, in Steinmetz's estimation, meant some uninteresting, uncreative task, usually monotonous and often mechanical repetition. The hardest worked men, according to Steinmetz, are those unhappy factory operatives who perform the same simple task over and over again for eight hours a day. The farmer who works from sunrise to sunset under himself as boss is not nearly so badly imposed upon. He can at least stop when he gets bored and turn from ploughing to feeding his chickens. Furthermore, his duties are different for every day in the year. One set of muscles doesn't grow at the expense of the others. His brain does not lose its flexibility or his spirit its initiative. He is a real member of society, not just a part of a machine.

"To succeed," said Steinmetz, "is to make a living at work which interests you. The work which interests you may not make you rich. What of that? The wise man learns to live. The shrewd man learns to make money. But the man who has learned to live is the happier of the two. Because his work interests him it is not work at all."

"The mechanical development of industry," he said, "is tending more and more toward the short working day. The problem of production has been

almost solved. The workmen in many factories do hardly more than feed the machines and pack up the finished product. But this improvement is not yet reflected in increased freedom. How soon," he asked, "is humanity going to reap the benefit of this advance? Men still work long hours, and their tasks, having none of the interest of individual work, are much more wearing to their bodies and degrading to their spirits. They have gained very little except additional ways to spend their money."

"Wouldn't it be better," asked Steinmetz, "if the workmen instead of using their increased wages to pay for nonessentials like radio sets and automobiles were to refuse to work more than four hours a day and spend the rest of the time developing those higher parts of their natures which get no chance for expression in the mechanical modern factory?"

This theory is very beautiful and is one held by many social idealists. Perhaps such a condition would be a fine thing for the race. But unfortunately almost everybody is friendly to it except workmen. They vastly prefer the higher wages gained by long working hours to the increased leisure at lower pay which they would have under the four-hour day. What the workman wants is not less work but a higher standard of living. He wants to share in the luxuries which he sees the middle classes enjoying in the better parts of

town. If you gave them the choice of earning their former wages in four hours or earning twice as much in the usual eight, they would all be back at the factory after lunch, each enjoying in prospect the improved position in the community due to the increased wage. Not one would be willing to remain in his old class just because of four more hours to loaf each day.

Steinmetz was devoted to this theory and talked a lot about it. He couldn't be convinced that it was impracticable. And the reason, as usual, was that he couldn't understand motives which he didn't feel himself. Money didn't mean a great deal to him. He didn't desire many of the luxuries buyable with money and didn't see why anyone else should. Nor did he want social position in the ordinary sense of the word. His professional fame gave him the position which most people have to seek through the manœuvres called social climbing.

What he did want to do was to work all day at the creative tasks which gave him so much pleasure, and his theory of the four-hour day was an attempt to give to others a taste of his own contentment. He couldn't be convinced that the average man wouldn't know what to do with a whole afternoon to devote to creativeness. He couldn't understand that there are very few people in the world with his amount of intellectual energy and resourcefulness.

An Accidental Statesman

In 1911 Steinmetz had his chance to go into politics. It was due to an extraordinary situation in the city of Schenectady which has no parallel anywhere else. The average hard-bitten politician of up-state New York would have no use for Steinmetz in any capacity.

This is how it happened. The most conservative and respectable church in Schenectady is the Dutch Reformed. It is a holdover from the days before the coming of the General Electric when the descendents of the Dutch settlers still had control of the city's social and business affairs. In 1911 the minister of this church was an ambitious and intelligent man named Lunn. He had mistaken his calling. He was really cut out for a public man. The itch to become a minister is really a desire to meddle in the business of other people and exert control over them. The same itch makes a public man. Which is why wild horses can't keep the ministers from mixing in public affairs.

Now this man Lunn was too liberal and modern minded for his congregation. He had a tendency in his sermons to rub the conservative fur of his parishioners the wrong way. He didn't believe most of the old bunk and he refused to say that he did. What's more, he began working politics into his sermons and

making his church the rallying point for a radical group. There was bound to be friction. As a result of it Lunn resigned and immediately gave his attention to politics—his proper calling.

The orthodox way to get into politics is to make friends with the local bosses and get them to nominate you for some minor office. If you make good and continue to do what they want you finally get an important office and become a boss yourself. The story goes in Schenectady that Lunn applied to the Republican boss and was laughed at. A radical minister out of a job wasn't what he wanted in his party. Not at all discouraged, Lunn tried the Democratic boss. Nothing stirring there either. The Democrats up state are always trying hard to be respectable. They don't want alliances which are apt to be both radical and unprofitable.

Still Lunn wasn't discouraged. The only other party in Schenectady was the Socialist. It was feeble and theoretical. It was made up largely of the foreign-born employees of the General Electric. It had never had a look-in before. So when Lunn offered himself as their candidate for mayor the Socialists jumped at the chance. They didn't hope that he'd win the election but his presence would remove some of the alien stigma and might raise them to a more respectable place in good political society.

Lunn at once started a whirlwind campaign. He was a wonderful speaker and he had plenty to talk about. A city which has been run without opposition by the same set of bosses for a number of years has always plenty of sore spots. Lunn smote them hip and thigh. To everybody's surprise he won. Anything seemed better than the established situation. And the word "Socialist" hasn't as nasty a sound to the foreign-born of Schenectady as it has to the average American.

This gave Steinmetz his chance. Although Lunn was by no means a convinced Socialist he had been elected on the Socialist ticket, and Steinmetz, another very mild radical, was just what he wanted in his administration. He could point to him as an example of the expert assistance with which he was going to run the city. Lunn also needed help against the more radical wing of his party. The Socialists have a by-law to the effect that anyone elected with their help must obey the dictates of the party council. Lunn had no intention of doing this and he knew that Steinmetz would support him.

So, shortly after Lunn's election, Steinmetz became president of the Board of Education. Intellectually he was well fitted for the position but temperamentally he was a flat failure. He was too honest for office in a city whose politics contained

all the usual elements of greed, self-interest, and prejudice. He observed in his naïve way that the city needed new schools and that the old ones were not being run properly. He did not observe all the tangled motives which must be unravelled before a construction programme can go forward. He was without the necessary guile.

The public school system is run in the last analysis to please the parents of the children, the politicians, the teachers, and the contractors who erect the buildings. The ultimate purpose of education is the last thing in the world for a school board to concern itself with. This is probably just as well, for if a board were able to enforce some of the more bizarre of modern educational fads the children would never get educated. But Steinmetz didn't know this and wouldn't learn.

Consequently his attempts to introduce many logical and much needed reforms in the school system met with little success. They were too direct and simple-minded to suit the cluttered political situation. Lunn backed him to the best of his ability but the mayor was beset with opposition from all the timid business men of the city who were afraid that he was about to abolish private property and declare the dictatorship of the proletariat. For years Steinmetz fought on confusedly, trying to put through his

programme. He got almost no results. Once he was elected president of the Common Council but this position failed to give him the influence he had expected.

All this activity depended solely on his intimacy with Lunn. There was no sign that the city approved of his Socialist ideas. It was not radical at heart and showed no signs of becoming so. After two terms as a much advertised "Socialist Mayor" Lunn himself deserted the party and became a Democrat—an affiliation which fitted him much better. Steinmetz was kept on the Board of Education, where his analytical mind and genuine idealism made him valuable. But he was never able to put into effect any revolutionary policies. In fact there was some doubt that he really meant to. Perhaps he was merely easing his Socialist conscience.

One more venture Steinmetz made into this unnatural field of politics. In 1922 he received the Socialist nomination for state engineer. He didn't solicit it or even contemplate it. The Socialists had no real hope of electing any of their ticket. The country was at the height of its cold shivers over the Bolshevik revolution. They had to put some nominees in the contest and they chose Steinmetz to prove their old contention that they were above the manœuvres and bunk of the other parties. They wanted an

authentic expert to show that under Socialist rule the usual political chicanery would cease.

Steinmetz wasn't cut out for a campaigner. His English hadn't lost its German twist and he was never eloquent in his own behalf. His appearance would have been against him. So he made a writing-desk campaign, giving long statements to the papers about the technical problems of the state and delicately hinting that he could solve them.

No doubt he could have solved any problem going if the office had been purely an engineering one. He had never failed as long as he stuck to his own specialty, but since all state offices are mixed up with a vast amount of intrigue it was probably just as well that he was defeated. He didn't understand such indirect matters. The New York water-power situation has stumped Governor Smith himself. Steinmetz could have produced the power efficiently but that's comparatively simple. The problem is who gets it after it is produced.

The announcement of Steinmetz's candidacy provoked a blizzard of newspaper talk. In the far bushes papers discussed it which had never given half a column to a New York election before. The chance to combine Steinmetz's magic name with the Red Menace which the faint-hearted saw hovering in every shadow was enough to make the lesser editors

weep with joy. The Socialist ticket that year had other items of interest. A printer was candidate for governor, a woman for lieutenant governor, and a Negro for secretary of state. Steinmetz's picture, always with the thin cigar between his teeth, appeared in this strange company on hundreds of front pages.

He was defeated. This was to be expected. No Socialist could have carried New York State. But it was significant that he polled nearly twice as many votes as the other Socialist candidates. The real Socialists voted for the whole ticket, but two hundred thousand non-Socialists voted for Steinmetz solely on the basis of his reputation. Which proves that sometimes the voters show more independence than they are given credit for.

This closed Steinmetz's venture into politics. It was a foreign field. He didn't belong there. If he had lived longer the Socialist Party might have leaned again on his reputation but he showed as little respect for them and their petty squabbles as he did for the larger parties picking their crumbs from the table of capitalism. He could never see the point of party politics. Let's add this to his other virtues.

PART SEVEN

OBSERVING THE WAR

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Theory Wanted

BETWEEN 1914 and 1918 there was a war. It affected us all more or less and the repercussions are still travelling around and around the world like the tidal wave of Krakatoa. It affected Steinmetz rather less than it did most people for he lived in a rarefied atmosphere of scientific fact which was not readily muddied by the currents of popular emotion. He was sorry of course that so many millions of men were trying so high-mindedly to kill each other but he was sorry in a detached way. He couldn't imagine for the life of him why they were doing it.

It would have been hard to find on any continent a man of prominence who looked at the war from a more theoretical point of view. When the first news came on that fatal summer day he was stunned as everyone else was. He couldn't believe it was true. He knew the temper of Germany; he had had some contact with that temper himself. But it was a long time ago and the rough edges of a grudge get rubbed off by the passage of time. The things he remembered

about the old country were pleasant things: the red carpet and kerosene lamp of Tauenzienstrasse, the beer and student songs of Breslau.

Running abreast with the first news from the battle fields came the leaders of those propaganda armies which were to struggle three long years for the great prize of an American alliance. Soon the papers were full of tales of violated women, murdered noncombatants, and little Belgians with their right hands neatly severed at the wrist. Steinmetz watched with amazement while his sentimental, soft-hearted race was vilified with emphasis little short of mania. A scientific training doesn't tend to make one believe such hysterical and poorly authenticated tales and Steinmetz didn't believe them. A habit of considering only the facts doesn't make one drift acquiescently with the tides of popular feeling and Steinmetz didn't realize what troubles he would bring down upon his head if he refused to drift with them. He continued in his faith that wars and such things can be analyzed scientifically like induction motors and the right allotted to one side without injustice. Here again he failed to take into consideration those frail, vague, human factors which, like the spider-thin fetter binding the wolf Fenris, so often prove stronger than the strongest economic forces. And, as always, he developed a theory.

In every war there has to be a villain. As soon as you take sides conclusively it is convenient to make this villain the enemy. The war will go forward with more enthusiasm. But for a neutral with various conflicting emotions the choice is sometimes difficult. Steinmetz looked long and hard for a nation with which he had no sympathy whatsoever and finally he found it in Imperial Russia. The ocean of Slavic barbarism has threatened to engulf Germany for too many centuries to be lightly forgotten and the Czar's government was the most active enemy of liberalism in Russia and out of it. For the first two years of the war Steinmetz heaped on Russia the chief blame for bringing on the conflict, hoped fervently that Germany would be able to withstand the onslaught, and sorrowed mildly that his beloved England and France should have shown such poor taste in picking an ally.

As the war progressed the theory grew and blossomed. From the beginning the propaganda battle in the newspapers went in favour of the Allies but the German-language press and the more skeptical magazines presented another version. The Russians have always had a talent for atrocities and the Germans, although pitifully weak propagandists, had only to look to Russian history for material more horrible than any Englishman would be likely to think of. The Eastern Front was never a polite place and a person

who like Steinmetz was looking for such things could find incidents in the Russian invasion of East Prussia which made the German advance into Belgium pale into insignificance.

Steinmetz was without guile. It never occurred to him to conceal his feelings, and he aired his opinions without reservation. One by one his friends began coming to his laboratory less frequently. The Englishmen and Frenchmen of Schenectady had long since left to take their places in the armies of their respective countries. The neutrals and Americans couldn't help being affected by the atmosphere of hatred stirred up by the Allied propagandists. This left Steinmetz with the others of German birth herded together in a compact group, an island in a ravenous sea which steadily gnawed away its timid shores bit by bit.

Justification by Print

IT WAS this feeling of disapproval which Steinmetz felt so strong around him which made him write *America and the New Epoch*. He wished to explain with the emphasis only possible to print just what his reasons were for thinking counter to the opinions of his friends and associates.

If you pin an old-fashioned Socialist down ruthlessly, suppress his squirming, and make him express

Courtesy of General Electric

"LISTEN, MICROPHONE, I HAVE A GREAT DEAL TO SAY."

his most fundamental convictions, you will find that he gives foundation-stone importance to the economic motive of all history. If he can rule out everything else, he is able to prove what he will. The only valid arguments against a Socialist are those noneconomic factors which rolled into one comprise what we call "human nature."

America and the New Epoch is written with two motives, one to justify the author's Socialism and the other to explain his position on the German side of the World War. I have dealt with the Socialist element in an earlier chapter. The other consideration was probably uppermost in Steinmetz's mind when he wrote the book. He never cared very much what the public thought of his Socialism. He was never criticized very actively for it. But the ill will caused by his pro-Germanism he felt very keenly.

Germany, he explains in this book, is the leading practiser of the economic system he calls "coöperation." Her success in world trade is due to her discarding the outworn doctrine of *laissez faire* and substituting the monopolistic trust whose efficiency crushes all competition. England, which made its national fortune under *laissez faire,* is still its leading exponent, and the war is the result of England's fear of being proved an economic back number. France takes England's side because of a fifty-year-old

grudge, and together they call on Satan in the form of Russia to aid them.

This is all very perfect and looking back as we can now without passion or prejudice, it seems as if this was exactly what did happen. Also viewing it calmly, it looked as if Germany would win. She had all the advantages of position and organization. Her allies were enthusiastic and subordinate. Her General Staff could pursue a complete and logical plan unhampered by national rivalries. She was supremely ready and her enemies for the most part were not.

But Steinmetz as usual failed to weigh the imponderables. A nation which worships the monopolistic trust is very effective in performing a given task, economic or military, but it falls down lamentably when it comes in contact with things more subtle and harder to understand. England won her victory with weapons the very existence of which the Germans would hardly admit. Her immaterial bonds with the Dominions proved stronger than the most iron-bound imperialism. Her influence over America turned this country in her favour, and her diplomacy in other parts of the world gained her invaluable allies.

Steinmetz watched this process with sorrow. He was unaffected by the propaganda. His scientific habit of looking beyond the externals for the solid facts

kept him above the popular furor. He would mentally hold up Germany in one hand and Russia in the other. Germany, the leading nation in science and one of the leading nations in every modern activity. Russia, still dark with barbarism and just beginning to seethe with horrors the rest of the world had forgotten a hundred years ago.

But events rushed by him fast. He saw America plunging with ever-increasing speed toward the whirlpool. America was his country now and had his loyalty. Germany owned the inner layers of his heart and toward Russia was directed what hatred there was in his character. He strove to reconcile these conflicting emotions, while his friends began cutting him on the street. There was no comfortable seat for Steinmetz in the grandstands surrounding the World War. He should have been allowed to stick to his laboratory and not made to observe the conflict.

The United States of Europe

IN THE beginning Steinmetz was sure Germany would win. So was everyone else except those courageous souls with Allied sympathies whose hopes were strong enough to outshout their fears. German arms were everywhere successful. The French crumpled back like tissue paper. The Belgian forts

cracked like egg shells. The field-gray armies flowed slowly but irresistibly like a thick syrup over northern France. The road to Paris was open. Beyond Paris were the Channel ports, and beyond the Channel ports lay England.

Steinmetz was somewhat shaken in his faith by the invasion of Belgium. He would have preferred to see his fatherland, a crusader of the light, advancing victorious into Russia while the western Allies looked on without too much regret. But Germany ignored Russia completely, trusting to that country's inherent clumsiness to protect her while she dealt fatal blows on her more civilized and dangerous enemies.

Then came the Battle of the Marne. The French made their famous forced march in taxicabs, and the German hopes for immediate victory faded into the background. Steinmetz saw that the war was going to be a long and destructive one. Also that it wasn't going the way he had predicted. He began to revise his theories.

By the time the struggle had settled down to a stalemate of trenches and barbed wire Steinmetz had a new and burnished theory ready to stiffen his inner resistance against the growing hostility of his associates. It was broader and more idealistic than ever, but he was surprised to find that it stirred up more opposition than any previous one.

Europe, said Steinmetz in 1916, was an economic unit of not much more ultimate importance than the United States. It was ridiculous in view of this fact that it should be divided up into a score of little feeble countries, no one of which was strong enough to give peace to the rest. The system of the balance of power resulted in enormous expenditures for armament with no net gain, while the customs barriers were a terrible handicap to trade. What a boon to the world if one country were able to dominate the rest and enforce coöperation between them! And what country was better fitted for the position than Germany? She was the strongest industrially; she was centrally located; she was more convinced than the others that elimination of competition was the economic doctrine of the future. Germany, thought Steinmetz, would be doing the rest of the world a good turn by beating down its resistance and enforcing a *pax Germanica*. He leaned back contentedly when this theory was finished, certain that it would prove a trustworthy basis for further remarks. But just then the *Lusitania* was sunk and he found himself the centre of a storm which would have appalled a more imaginative man.

The newspapers took avidly to Steinmetz's phrase, "a United States of Europe." They spread it on a thousand front pages and presently daubed it in a thousand Sunday magazine sections with additional

remarks about how this United States was likely to be governed by a victorious Germany. Practically all women were to be violated at once and nearly all children were to have their right hands severed neatly at the wrist. Steinmetz sadly read the clippings, which came from his agency in greater numbers than ever before. Sadly he turned back to his laboratory where the volts and amperes spoke a reasonable language not twisted and corroded by patriotism or hatred.

Socialist Absolution

By the time the *Lusitania* was sunk America was making up its mind to go into the war. Presently Wilson had won his second campaign on the slogan "He Kept Us Out of War" and felt safe in changing his position. The reluctant West was showing the effects of intensive propaganda and was becoming more warlike than even the East, which had been pro-Ally from the start. The officials in Washington were preparing for the inevitable conflict. One of their schemes was a Naval Advisory Board, sponsored by Secretary Daniels, "The man who made the navy dry."

This board was to be made up of inventors and scientists who were to be nominated by the leading technical schools. For fear that these schools would

nominate only their own favourite sons, Secretary Daniels announced that there were certain men whom he would appoint irrespective of whether they were nominated or not. In this select list of three or four was Steinmetz.

As soon as the newspapers got hold of this information a roar of protest went up from all over the country. Steinmetz was unfit for such a confidential position. In the first place he was German-born and accordingly was apt to place devices on battleships which would sink them as soon as they left port. In the second place he was a Socialist and therefore untrustworthy. In the third place he was a pacifist and didn't know anything about war or he wouldn't be one.

Back and forth the battle was fought—in the news columns, on the editorial pages, and in "Letters to the Editor." Steinmetz had been appointed. Steinmetz had been rejected. Steinmetz had been appointed and then thrown out. Nothing conclusive was decided. The Advisory Board was a half-baked idea at best. Edison made a dozen inventions, none of which proved very useful, and the whole matter was submerged when America did actually enter the war. Steinmetz was left in his Schenectady laboratory, where he belonged and where he was most useful to the country at war or at peace.

But the controversy left him not much delighted with the ways of war psychology. He was hurt because he wasn't considered a real American. Why? He'd even changed his name to break his last connection with the Fatherland.

In 1917 came the Russian Revolution. Steinmetz read the news breathlessly and hopefully. When America finally entered the war he had had to discard his theory of "the United States of Europe" for he realized that the defeat of Germany was only a matter of time. No one can live in Schenectady, the Electric City, and doubt this country's power. Now Steinmetz saw in the Russian Revolution the basis for a new theory more perfect and beautiful than ever. Germany would be defeated and should be. It would be the best thing imaginable for the world, for this would leave it free to learn the lesson being taught so brilliantly by Russia. The last antique autocracy had collapsed into ruins. The milder bourgeois despotisms of Europe would adapt themselves to the new conditions, and when the smoke of war had cleared away America and Russia would lead the world by gentle stages toward the Socialist Utopia. With Kerensky's fine words humming softly in his ears, Steinmetz worked contentedly in his laboratory, watching for the first signs of the new era and happy that he should be alive to see it come.

But Kerensky's fine words ceased coming across the Atlantic and Kerensky himself fled before a breaking storm of anarchy and savagery. Then tales began worming their way out of Russia which made the world shudder with horror and made Steinmetz revise his theory.

The Utopia, it appeared, was still some blocks around the corner. Steinmetz by no means believed all the stories which came from Russia. They bore too much of a family resemblance to the tales of German atrocities and he was very skilled in discounting such. But it was quite apparent that for some time at least the Bolshevists would find their hands too full to attend to the details of establishing the ideal Socialist state. Steinmetz reserved his judgment for the present. He smiled with mild incredulity when he heard of the "nationalization of women." That was a happy phrase. He wondered where it originated. He shook his head with hopeful disbelief when he read lists of the executed and murdered which looked like dollars in the national debt. He decided to wait. Presently some of these people would come to life again and then the world would see what Socialism could do when it really got a chance.

He had to wait a long time. It was not until 1921 that his Socialist friends began to bring him evidence from Russia which showed some signs of the awaken-

ing for which he watched. By that time the anarchy in Russia had settled down to a condition which looked in comparison almost like healthy order. The Soviet régime had removed very conclusively all opposition and was able for the first time to think of other matters than its own survival. The first thing it talked about was the electrification of Russia.

Here was an idea which Steinmetz could seize upon definitely and praise without reserve. For years he had preached electrification as one of the chief agents of Socialism. If a country was bound together closely by power lines in the inevitable control of some central agency, and if that agency drifted more and more toward government management, there was sure to be a parallel drift in other lines. The Soviets, perhaps, had been a trifle hasty in making other changes before this fundamental one was assured, but they doubtless meant well and now they were taking steps in the right direction. He could do no less than applaud. To register his applause he sat down and draughted a letter to Lenin.

In 1921 the mail service between America and Russia was nonfunctioning. A letter might be sent, but it would linger about in the Baltic states perhaps forever without reaching its destination. And if it did get to Moscow it would probably never reach Lenin, who had surrounded himself with a bureaucracy as

ponderous as ever existed under the Czar. So Steinmetz waited to mail his letter until he was able to intrust it to a Communist named Lussof who was returning to Russia and who promised to place it personally in the hands of Lenin.

Steinmetz wrote:

DEAR MR. LENIN:

I am taking the opportunity of the return of Mr. Lussof to Russia to express to you my admiration of the great work which is directed to the building up of Socialism and economic reconstruction—the work which Russia carries on under such hard conditions. I wish you full success and express my full confidence that you will succeed. And really the great undertaking started by Russia must end by success, for we cannot permit that we shall be defeated.

I shall be glad if I am able, according to my best abilities, to assist Russia in the technical sphere, and particularly in the matter of electrification in a practical way and with advice.

Yours truly,

CHARLES STEINMETZ.

After he'd started this letter on its way Steinmetz felt more at peace with himself than he had since the Red Terror had shaken his faith in Socialism. He was glad that at last he could ease his conscience by making a friendly gesture to the reigning pope of his Socialist religion. Perhaps there was still hope for Utopia.

A long interval and then the answer came back. Steinmetz read it with deep satisfaction. Written

below a picture of Lenin was a note in his own hand, signed "N. Lenin" at the bottom. It thanked Steinmetz for his sympathy with the Russian experiment and regretted that the lack of relations between Russia and the United States prevented the Soviet from taking advantage of his offer of technical assistance. It was a great consolation, said Lenin, to know that at least one great scientist in a capitalist country had confidence in the high intentions of the Soviet.

Steinmetz hung the picture on the wall of his laboratory. He often looked at it with delight. Lenin smiled back at his eminent little worshipper. The picture was not at all like those we're used to. Lenin wasn't the glaring ogre of the newspapers, but a pleasant, highly intelligent leader, well worthy of his place among the Russian saints in the icon corner of peasant huts. Steinmetz showed it proudly to unsympathetic visitors. Against all kinds of opposition he had remained true to his Socialist faith. Here was proof of it.

PART EIGHT

TOWARD THE END

TOWARD THE END

One Emblem of Mortality

SOME men dread death. I don't think Steinmetz did. At any rate he gave no sign. Probably a cripple gets so used to feeling the presence of death around the corner that he develops an almost friendly regard for it. Has a little word of greeting all prepared for the moment when it shall finally confront him.

Apart from spiritual cowards only two kinds of men fear death. The speculative sort of person dreads a moment of awful blankness, or, if a trifle old-fashioned, he looks forward to another and problematic existence. The man with a task to finish in life regrets that he has not had time to complete it. Such tasks are never completed. But Steinmetz was neither of these. Where there was no evidence he never speculated. And his scientific work he did not consider a duty to the world. It was a mere function of his body, the thing he liked to do best and the thing which had won for him the position he enjoyed. If life was the functioning of a machine there was nothing strange about its stopping. Steinmetz had seen many machines

hum down the scale to silence at the snap of a switch. Even that life-long friend, the induction motor, eventually wore out. Steinmetz had seen many of them cut off from their life-giving current, borne out to the junk pile, and torn apart into copper wire and scrap iron. The process seemed quite orderly.

But there were some signs of age which annoyed him. He did not grow old normally. His nerves went first. No spectacular breakdown, no jumpiness or undependability. That wouldn't have been as bad. At least it was common around him. His nerves merely became slower in their action. His muscles didn't respond as promptly to a stimulus. He found them obeying whole seconds late the commands which his still efficient brain had given them.

The effect of this was not only tragic but ludicrous. And a ludicrous defect is much more painful than a dangerous one. For years Steinmetz had ridden a bicycle. He never rode very well and the machine had to be specially designed but at least it rolled over the ground quite as smoothly as if an athlete were guiding it. But bicycle riding requires above all things rapidity of coördination. Small emergencies constantly arise which have to be dealt with at once. If not neutralized promptly every bump in the road threatens to upset the balance.

Steinmetz observed that little by little the response

of his arms grew slower. It wasn't serious at first. He merely wobbled a bit more than before. But one day things came to a crisis.

He was riding down the long straight street to the office when he came to a certain corner which had to be turned. He had turned it successfully a thousand times. He was going rather fast. When the exact time came to act his brain gave the signal for his right arm to pull on the handle-bar. But nothing happened. There was a sickening pause. Then the arm responded. It was too late. Wobbling wildly, he ran up on the front lawn of the house beyond the corner.

This was the end of bicycle riding for Steinmetz. His confidence was shaken and his reactions became even slower. None of his accidents was serious but it was only a matter of time before a bad one would happen. The bicycle was put away in the background with the other emblems of normality which Steinmetz had had to abandon one by one.

Some Gods Fraternize

SUCH little incidents might worry him in private but they didn't affect his standing in the world. He was now at the height of his fame. The newspapers were more greedy than ever for the privilege of printing his slightest opinions. And the men whom the world con-

sidered great came to visit him in crowds. In 1921 came Einstein, wandering around this country a trifle perplexed to observe the popular interest in a theory which only a handful of Americans understood. He and Steinmetz were made for each other. They talked mathematics delightedly for hours. Einstein was glad to find someone he could talk to on his own plane and Steinmetz was glad that, although he had never met Lenin, he had seen the other truly great man of modern times.

In 1922 came Marconi. A very different person from Einstein. Steinmetz didn't find as much community of interest with him. Science was for Marconi a means to an end, not a pure simple joy in itself. But they got along nicely. Steinmetz took him out to his house and showed him his pets.

"Where's your Gila monster?" asked Marconi, who read the papers and hadn't missed this stage property of Steinmetz's reputation.

"He's dead. He was too lazy to eat. And my alligators ran away."

"Too bad. Now you'll have to go to work."

It is not recorded whether Marconi slapped Steinmetz on the back at this point but he might have and Steinmetz would have loved it. This sort of foolery pleased him. He was delighted to see it in a man who had as great a reputation as his own.

Edison came, too, and sat in Steinmetz's office talking impressively along the borderline between science and scientific opportunism. He was very deaf, so when Steinmetz saw that his remarks were making no impression he reached over and, to the delight of the ever present reporters, tapped a message in the Morse Code on Edison's knee. A smile of respect and amazement spread over Edison's face. Here was a man after his own heart, who'd never been a telegrapher, but who knew how to tap out a message with the best of them. For a long time the two men communicated in this way. The reporters stood around in silence, not understanding a thing, but happily framing in glowing words the "human-interest story" they would send to their papers that afternoon. Such an item gets you more credit than any amount of scientific news.

Thunder and Lightning

THESE visits from the scientific headliners aroused in Steinmetz a desire to do something which the public could eat up without danger of indigestion. Electrical engineering achievements were all right. They were genuine contributions to science and they had won for him a tremendous renown among specialists but they were enveloped in so dense a shell of protective mystery that the public, which was

becoming more and more dear to him, could not get the faintest idea of why they were important. The little anecdotes about his cigars, his Gila monster, and his cacti helped to establish some contact with the public mind but they were mere auxiliaries. They might have been told about a Y. M. C. A. secretary or a prize fighter. No, he'd have to do something which the public would understand and which would be sufficiently spectacular to attach to him permanently those delightful words, "wizard" and "magician."

It mustn't be assumed that Steinmetz reasoned consciously to any such effect. He was devoid of cynicism, even about the public. But in his old age he had become very vain and he loved to have people of no scientific knowledge point to him awe-struck. His colleagues already did but that was an old story and there weren't very many of them.

Toward the end of his life his scientific work had become rather like a boy's playing with machinery. He would read about an experiment in a technical magazine and then go to his laboratory to try it out himself. His great work was done; originality had deserted him. There remained the small child playing with electricity but a small child accustomed to public praise and avid for more of it. So it was natural that he should begin to play with lightning, the

aspect of electricity which occupies the largest place in the public's imagination.

Although Steinmetz at this time was not in a purely scientific state of mind these experiments with artificial lightning were not mere foolery. They had a definite place in electrical engineering. From the beginning lightning had been one of the biggest problems for the constructors of power lines. It wasn't a matter of one splintered pole or one smashed insulator. Sometimes whole lines would be wrecked, great transformers ruined, and even the generators themselves fifty miles away put out of commission. The individual lightning flash was easy to deal with. A rod could be put on each pole and the flash conducted safely to the ground. But in its passage it would sometimes stir up sufficient disturbance in the wires to wreck the whole system. Induced currents would cause a low-resistance arc from the wires to the ground, the distant generators relieved of their load would race madly, and the whole power of the system would flash to the earth in one tremendous short circuit. To prevent this something had to be learned about the habits of lightning.

The mere producing of a high-voltage current was not enough. It had been done before and the results were not a bit like lightning. It was dangerous enough to suit anyone but hadn't the destructive, blasting

effect of the lightning bolt. The current must be large as well as the voltage, and to produce this large current at a pressure of several hundred thousand volts was the problem which Steinmetz had to solve. A dynamo which would generate this current continuously was out of the question. It would take all the power in the country. And lightning doesn't have to be continuous. So Steinmetz's problem was to store sufficient electricity in a condenser and release it all at once in a tremendous burst of power.

As it turned out this wasn't very difficult. Steinmetz constructed a condenser larger and more powerful than any known before, connected it with a machine producing a trickle of high-voltage current, turned on the juice, and waited to see what would happen. It certainly did happen. When the condenser was filled to a certain point there was a blinding flash, a terrific detonation, and the room was filled with a cloud of metal vapour and pungent ozone. Steinmetz rubbed his hands, turned off the current, and prepared for a real demonstration. This experiment wasn't merely scientific. It must appeal to the imagination as well.

Loki Entertains the Gods

WHEN Steinmetz completed his preparations he issued invitations. They were all accepted. Sche-

nectady's greatest scientists were there. The magnates of the company came in a body—and the press. Such a lot of reporters, all brimming with enthusiasm for the little man who was gong to provide them with abundant copy, maybe front-page stuff.

The guests found the familiar laboratory filled with new and strange apparatus. At one side were rows of thick glass plates carefully insulated and connected with heavy copper bars. A high-voltage machine sat silently in a corner, quietly conscious of its power. A myriad of switches suggested all-wise complication. But the centre of interest was a miniature village, gayly painted, which stood on a shining copper plate surrounded by artificial trees. Above this was a network of heavy wire supported on four-foot porcelain insulators.

When the audience was assembled Steinmetz made a short speech. This apparatus, he said, indicating with a gesture the glass plates, was designed to approximate the conditions in a thunderstorm. The power was provided by the high-voltage generator —another gesture—and the little village was the victim. Steinmetz looked around hastily, pushed back a couple of reporters who had approached, notebooks in hand, too close to the danger line, and turned an inconspicuous switch. There was a subdued hum and glow from the vacuum tubes of the generator. Then a

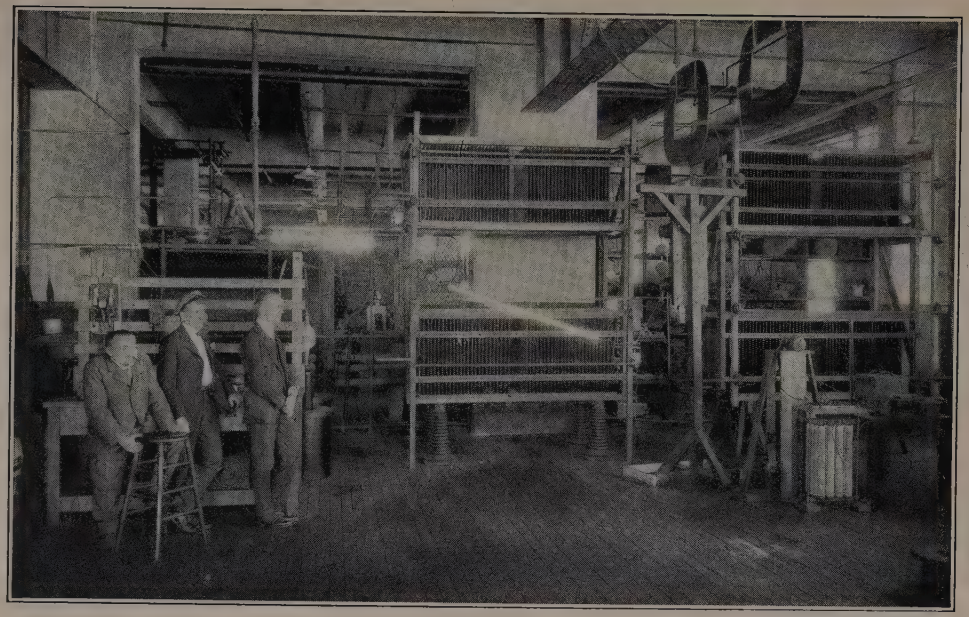
long wait. Steinmetz was the only man present who wasn't nervous.

The steady hum continued its monotonous note, while the atmosphere grew more tense. Then came a terrific crash. A long flame broke from the wire netting. The white steeple of the little church disappeared in a cloud of smoke and fragments. Steinmetz snapped off the switch and the spectators rushed to see the destruction like fox hunters in at the death.

The demonstration was entirely successful. The church was shattered into a thousand splinters; the air was full of smoke, and the copper plate was melted where the church had stood. For a moment there was silence broken only by the fluttering of the reporters' notebooks. Then everyone was congratulating Steinmetz and slapping him on the back.

The next day the front pages were ablaze with his name. The headlines spoke huge words.

MODERN JOVE HURLS THUNDERBOLTS
ELECTRICAL WIZARD IS 1922 JOVE
SCIENTIST INVENTS THUNDERSTORM
WIZARD HURLS THUNDERBOLTS
DR. STEINMETZ SCHLEUDERT, JUPITER GLEICH, BLITZE
MODERN JOVE SITS ON THRONE AND HURLS THUNDERBOLTS AT HIS WILL



Courtesy of General Electric

BACK-STAGE AMONG THE THUNDERBOLTS

The editors were delighted with Steinmetz's performance. They showed their gratitude with oceans of ink. The reporters took vacations on the strength of their stories and even his brother scientists had to hand it to him for a spectacular demonstration.

There had been a time when Steinmetz would have scorned such pseudo-science, but that was long ago when he was doing the work which makes him worshipped by electrical engineers. This experiment contributed very little toward scientific progress. It added not a chapter to his works. But the headlines rewarded him lavishly. He was secure in the title of "Modern Jove." Again it was demonstrated that the most detached and sincere mind can fall victim to the habit-forming drug, publicity.

Steinmetz and the Ministers

FROM the time of the lightning machine Steinmetz rested on his laurels and enjoyed his position as a popular idol. He was besieged by reporters who asked his opinion on everything from power rates to religion, neither of which, of course, he knew very much about. But his mind didn't rest. It didn't know how. And since it was not as completely taken up with scientific work as formerly it wandered farther

afield into regions of thought hitherto quite unexplored.

Steinmetz had never given much thought to religion. One does not find God among the test tubes, and Steinmetz at least had not found Him among the green trees of Camp Mohawk. But religion is the easiest of all matters to generalize about and an active mind always comes to some sentiment concerning it. The stratum of the population which reads the cheaper newspapers is more actively interested in religion than in anything else. It forms the major part of those people's intellectual diversion, if any. So inevitably the reporters began to ask Steinmetz for his religious articles of faith. As they expected, they found that he had none, but he was just as willing to talk about them as if he had.

Once his mind was started on the religious road it went quite a distance. Of course there was only one attitude for him to take—that of orthodox scientific skepticism—but he was so moderate and good-natured about it that even the ministers took no offense. The modernist ministers hope to reorganize their views so as to fall in with the principles of science and bask once more in the good opinion of the world's intellectual leaders. The only analysis they resent is an attack on their fundamental motives, for if these are shown to be obscurantist and

bad there will be no chance for an intellectual reform to regain for them the position of leadership which they once held. Steinmetz in his opinions never attacked anyone. He didn't care enough, and definite attack was a weapon which he never used. So the ministers welcomed his comments and never denounced him as an atheist. One liberal denominational magazine, the Unitarian *Christian Register,* even asked him to write two articles for it on his beliefs.

These articles drew the inevitable line between scientific weighing of evidence and religious taking on authority but they did it in so conciliating a way that no one got angry. Steinmetz gave to religion that minute loophole which is all it needs to ask. He assigned to faith the nebulous region lying outside the experiences of our senses. The ministers know that once the existence of this region is admitted they need fear nothing. They even rejoice in their segregation for they know that beyond the senses facts have no currency and need not be dreaded.

"There is," said Steinmetz, "no evidence outside of science for God, immortality, and similar conceptions, and there is evidence against these conceptions in science, and science has justified its methods and conclusions by the work it has accomplished.

"But it is hard for man to get along without belief

in these conceptions. We may get along without a God but not without immortality. Our self-conceit dislikes to place so little value on ourselves, our knowledge, our skill, experience—in short our Ego—to concede that all this is merely a function of the biochemical process of life which will utterly cease and vanish with the disintegration of the protoplasm of the body by death.

"But all conclusions of science depend on our observation by means of the senses. Religion deals with the infinite which cannot be conceived by the senses. Also we reason by means of logic, whose rules are only thought to be true because of experience.

"This, the negative answer of science on the question whether there are conceptive entities of infinite character, as infinite in time and space, immortality of the Ego, God, etc., is not conclusive, and the question is as open as before.

"There can be no scientific foundation of religion, and *belief* must always remain the foundation of religion, while that of science is logical reasoning from facts, that is, sense conception. All that he can say is that the two, science and religion, are not necessarily incompatible, but are different and unrelated activities of the human mind."

A great many ministers read these articles and gave small inward cheers. The more intelligent

among them have ceased to fight science, knowing that the battle is hopeless. They must hunt around for the crumbs dropped from its table. Steinmetz was easy-going enough to drop numerous crumbs. He conceded to religion the whole vague region which is at present beyond the reach of the test tubes. This is enough. Science will nibble bits from this territory from time to time but there will always be enough left over to fill the collection plates.

Another Way to Dispose of Pearls

WHEN a monarch feels his popularity and rejoices in it he is apt to make a royal progress through his kingdom. It is a pleasant function. It pleases the monarch to see so many of his admirers and it pleases the admirers to see him. These two emotions act together to increase the mutual esteem.

So when Steinmetz had the opportunity to make a progress through the Pacific Coast states he jumped at the chance. In 1923 the Western section of the American Institute of Electrical Engineers invited him to speak at its meeting at Del Monte, California. As soon as he announced his intention to accept, other invitations began pouring in. There was tremendous curiosity to see this queer little person who had made over electrical science and was inhabiting the front

page so continuously. The papers of the Pacific Coast began to buy "Modern Jove" articles from the feature syndicates in tremendous quantity. Every little city between Denver and San Francisco clamoured for his appearance. He accepted all he could, with some misgivings but with a very warm feeling that he was appreciated.

The first public address was at Denver. Here the local chapter of the institute had engaged a small hall and gathered its members to hear the distinguished scientist. But it reckoned without the public. Long before the hour for his appearance the hall was filled to the doors. The meeting was hastily transferred to the largest auditorium in the city, which could seat five thousand. It too was filled long before Steinmetz reached the platform.

In that tremendous room he appeared smaller than ever but he was equal to the occasion. Luckily the subject of his talk was one which admitted considerable popularization. The title was "The Power Industry," and he outdid himself in making it interesting. The audience applauded again and again, even when each individual realized that neither he nor any other non-technical hearer had any idea of what it was all about. They didn't care. They enjoyed the important words flying so distantly over their heads. Science to a great extent has fallen heir to mysticism.

Still-born Regrets

FROM Denver the tour proceeded to Colorado Springs and then to Los Angeles, where Steinmetz was received with even greater popular adulation. There were dinners and dinners and lunches and an address before a packed auditorium. Then Steinmetz went out to Hollywood as a guest of Douglas Fairbanks to take a look at the picture industry.

He wandered about this weirdest of cities and was thrilled to find something which he knew almost nothing about. When he went to the movies it was only to see the most childish of Wild West stuff. No sex. No art. No costume pictures. He wanted to see on the screen only the things he liked to read about in his dime novels. The rest of it was entirely beyond his specialized powers of appreciation.

Douglas Fairbanks showed him all around his company's lot and demonstrated the amazing machines which contribute with such intelligence to the stupidest film. Steinmetz was amazed. He had heard that electricity played a large part in the picture industry but here were uses for his favourite force which he hadn't even dreamed of. Fairbanks was overwhelmed by a flood of questions. He vainly tried to answer the less technical of them but finally in despair turned Steinmetz over to the obscure experts

who form the background for a famous star. Steinmetz got along finely with them and he left the lot with his head buzzing full with fascinating new ideas. For a time he felt the enthusiasm of youth and his prime. There was still such a lot to be done.

But as soon as he got back to his hotel Hayden came in to remind him of his evening engagement. Wearily he changed his clothes. The talk that night was on "Electricity and Civilization." Sugared pills for the curious. Not without penalty does science let itself get smeared with the ink of the front page.

An Insulated Conversation

STEINMETZ'S tour of speech-making carried him to nearly every town of importance on the Pacific Coast, and everywhere he was greeted with the same enthusiasm. The papers ran almost verbatim stories of his addresses and editorial after editorial appeared in praise of the man who had made hydro-electric power, which in turn had made the Pacific Coast. They take their electricity very seriously out there. It largely replaces coal and the people are duly grateful to the men who make it possible.

On the train back to Chicago he had an interesting encounter. William Jennings Bryan was on board and asked to meet him. Steinmetz was sitting alone in his

stateroom looking out of the window when Bryan entered. He at once recognized the familiar face of the pseudo-statesman with the light of fanaticism burning in his eyes. He greeted him warmly and Bryan immediately broached the matter nearest his heart—the only matter which really interested him. He was looking for sentimental loopholes in Steinmetz's disbelief.

Bryan in private with no others present to whom he could orate was very different from Bryan on the public platform. He deplored disbelief in his rather simple-minded God but he realized there was no use displaying his feelings when he had no audience which could be induced by appeals to emotion to sympathize with him. So the discussion was calm and reasonable. Steinmetz had nothing to lose by frankness and Bryan had nothing to gain by emphasis.

Steinmetz enjoyed hugely this meeting with the leader of all that was silly in religion and politics but for the life of him he couldn't develop any antagonism. Bryan was so pleasant and conciliating. They talked for a long time, coming to no agreement on anything but discounting rather than opposing each other's opinions because there was no one else there to hear them disagree.

Bryan asked most of the questions, presumably because Steinmetz realized that there was no use

trying to get facts, the only things which interested him, out of a reservoir which contained nothing but sentiment. Bryan was not interested in facts and Steinmetz presumably had as large a stock of sentiment as any man.

Pleasantly and reasonably Steinmetz explained the position of the orthodox scientist. He could believe nothing without proof and accordingly he had pushed God and religion back into the most cobwebby corner of his mind. He granted that the inherent irrationality of human nature left some distant field for religion but disclaimed any desire to explore that field for himself. He advocated the study of the Bible by children, for he considered it a great book and one containing remarkably little religion.

Bryan listened politely enough, rocklike in his conviction that science was a fraud and revelation the only true knowledge. The two parted in a friendly state of mind, Steinmetz to return to his somewhat dusty test tubes and Bryan to continue tilling the sterile soil of rural faith.

This meeting with Bryan is a fitting last episode in the life of the enthusiastic little scientist. His useful work was almost over now and he could afford to smile indulgently at those human weaknesses which would have aroused him to fury in earlier years. So on parting he pressed warmly the hand of the Great

Mogul of bucolic bigotry who was shortly to meet his Leipsic at Madison Square Garden and his Waterloo at Dayton, Tennessee.

The End

THERE isn't much more to tell. Steinmetz's life is nearly over now. He is fifty-eight and his body has decided to stop running. All considered, it did remarkably well to keep going so long. At least it nourished the brain during the vital years which bore such important scientific fruit. If it had been looking for excuses it could have found plenty. Every life process had to run in zigzags.

The Pacific Coast trip was the last effort the body was able to complete. On his return to Schenectady Steinmetz sank rapidly. He found it difficult to walk from the train to the taxi and when he reached home the doctor told him to stay in bed awhile and rest. Perhaps he recognized the death sentence so gently pronounced. Probably he did not. At any rate he stayed quietly in his room, protesting now and then because he couldn't go to his laboratory, but devouring scientific literature as greedily as ever.

One morning about breakfast time Hayden went up to see him. Steinmetz was awake and cheerful but he seemed uncomfortable. Hayden told him to take

his heart medicine. He'd bring him his breakfast presently.

"Keep still. Don't try to do anything."

"All right," said Steinmetz, settling himself back on the pillow. "I'll lie down." Those were his last words.

Presently up came little Billy Hayden with the breakfast tray. He found Steinmetz lying as peacefully as ever, but dead. His heart had stopped. On his face was no sign of pain or surprise. He had died as naturally as an electric motor. The current was cut off. The motor lost momentum, ran slower, and stopped. That was all.

Wonderfully soon the news reached the General Electric offices and the officials of the company came up in a body to pay their respects. Telegrams began to arrive from all over the country. Scientific societies, electrical companies, and plain individuals at home and abroad sent their last thanks to the man who had made their work so much easier to do.

The funeral was almost a state function. Steinmetz's name had penetrated to the most preoccupied minds and everyone high and low came to see him buried. How Steinmetz would have loved it all! The reporters. The lieutenant governor. The president and chairman of the company. Scientists and magnates in flocks. All genuinely sorry and genuinely worship-

ful as they carried the small, light coffin to the graveyard.

Some months later the General Electric got out its annual report. With impressive and formal figures it told its stockholders how business had been during the year.

Net sales billed	$271,309,695.37
Cost of sales billed	$241,653,948.80
Net income	$ 38,001,528.18

And the cheering sum, "Profit available for dividends, $38,525,118.32." But there was a great loss also recorded in the report. It couldn't be incorporated into the figures or subtracted from the total. It was too subtle. Its value was measured in prestige, in self-confidence, in good-will, and in publicity value. But the stockholders had to be told about it. Here is the entry on the red side of the ledger:

Dr. Charles P. Steinmetz died on October 26, 1923, after thirty years of devoted service with your company.

THE END